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End of a Controversy

The controversy between the British Iron and Steel Federation and the Council of Ironfoundry Associations as to whether the decline of steel production during 1951 was to a serious extent due to the ironfoundry industry receiving more than its fair share of pig-iron should never have been made a matter of public discussion. It is obvious that the lowered steel output was caused by the reduction in scrap importation and the C.F.A. have made it quite clear that in exceeding their non-existent target, they were largely withdrawing material from their stocks. The answer of the C.F.A.* has been forthright, courteous and convincing.

There has been a second phase to this Press and radio campaign, however, which is quite interesting as it is a technical matter. It is almost an adage in technical Press circles to ignore, because there does not exist the essential specialized background knowledge, any announcement appearing first in the daily Press about technical developments. For example, one which suggested the replacement of castings by steel pressings in the making of cookers, bath-tubs and the like, enters that category. Manufacturers of these articles are businessmen, who are not wedded to any particular production process. One very large electrical-engineering firm approached us some time ago as to the possibility of obtaining orders for uncored castings for their mechanized foundry. Further enquiry disclosed the fact that as they could get no sheets for pressing out some of the components for a line of electric cookers, they had temporarily to shut down the foundry. It is this type of experience which dictates the policy of eliminating, as far as possible, reliance on the outside supply of components or raw materials. Another aspect of the problem has been well expounded by Mr. J. E. V. Jobson in a letter to the *Financial Times*—the newspaper which has been giving space to this notion.

The ironfoundry industry has had a "good Press" for its answer to the campaign and both sides would now do well to follow the advice given by *The Times*, to settle their joint problems in consultation with the Ministry of Supply. We are not sorry that this *affaire* has arisen, for it has done more than anything previously to teach the general public that the foundry industry is not part and parcel of the iron and steel trades. The line of demarcation having been well established, the two industries can and should co-operate for their mutal benefit and for that of the country they are both proud to serve.

As we go to Press, we learn with deep regret of the death of His Majesty King George VI and on behalf of the foundry industry we tender to the Royal family this expression of our most sincere sympathy.

* See page 145 of this issue.

Institute of Vitreous Enamellers

Midland Section Notes

Nearly 100 members and guests of the Midland section of the Institute of Vitreous Enamellers attended the annual section dinner at the Imperial Hotel, Birmingham, on January 25. After Mr. A. Biddulph, section chairman, had proposed the Loyal toast, Councillor A. G. B. Owen, O.B.E., J.P. (of the Rubery Owen Organization), proposed that of the Institute. In a short speech he praised the really worthwhile technical aims of the enamellers, and felicitated them on the absence of any price-fixing agreements. The president of the Institute, Dr. J. E. Hurst, J.P., responded, stressing the need for training within the industry to be by practical men with feet firmly on industrial ground, rather than by professors with heads in the clouds.

The toast of the guests, proposed by Mr. Biddulph from the angle of an enamel manufacturer's "serviceman," thereby causing much derisive laughter, was replied to by Dr. W. H. Hampton, technical director of Chance Bros., Oldbury (glass manufacturers). In a witty homily, he advised the Institute to seek publicity for its activities, saying that publicity was very simple to secure: all that was necessary was to be so good that publicity was not needed and one would get more than enough, he said. The evening was happily rounded off by light entertainment, and at the close the secretary, Mr. D. Sleath, was congratulated on its organization. A further social function, to which ladies are invited is to be held at the Star and Garter Hotel, Wolverhampton, on March 14.

Latest Foundry Statistics

According to the December Bulletin of the British Iron and Steel Federation, the total number of employees in the ironfounding industry on November 10 was 151,956, an increase in the month of 539, of whom 453 were males. As compared with a year ago, the increase is of the order of 4,500. During November, the weekly average melt of steel for steel castings was 10,500, a matter of 200 tons a week more than the October melting rate, and 1,300 tons per week higher than in November, 1950. The average weekly production of steel castings in November was 4,900 tons.

From Football to Foundrywork

Shown here helping in the foundry, "Billy" Wright, captain of England and Wolverhampton Wanderers Football Club, is to begin work at the Great Bridge Foundry Company, Limited, West Bromwich, Staffs, in the near future. He will not forsake football—yet. When his training permits he will go from the Molineaux ground at Wolverhampton to the foundry to study iron founding at shop floor level. Later, he will become an executive of the firm that has offered him this job outside football. All his football training will be as usual. He will be on the track every morning, take part in practice matches, and go off to work in the afternoons.

Lifting Old Tram Tracks

As has been repeatedly pointed out, there are many tens of thousands of tons of disused tram lines embedded in roadways all over the country—the total for London, it is alleged, being some 60,000 tons. Such rails weigh about 100 lb. per yard and, cut to furnace sizes, provide first-class heavy scrap of just the kind which the industry needs. Of recent times, economies have militated against the recovery of this valuable material. To lift the rails from the roadways by manual labour, using simple mechanical aids, is nowadays so expensive that the value of the recovered rails is but a small proportion of the cost of lifting and making good. Indeed, the true overall cost has been regarded as well nigh prohibitive, notwithstanding the increased price of scrap, and many public authorities have preferred to leave the rails as they lie.

It was obvious that the overall cost could be enormously reduced if the removal process could be speeded-up. With these considerations and certain other technical ones in mind, George Cohen Sons & Company, Limited, the well-known engineers and scrap merchants, have now designed and produced a mechanical device, which is used in conjunction with a large excavator and allows the removal of the tramway track from the roadway at a speed approximately ten times faster than that attainable by the old methods. It has been shown that the first machine the firm are putting into use will deal with rather more than half a mile of rail per day. It is believed that this rate can be substantially increased as operators become more skilled and more machines can certainly be provided if necessary, but a very important point is that the resurfacing of the road after rail removal must keep pace otherwise there is the risk of serious and costly inconvenience to traffic. The rail removal machine was impressively demonstrated in a London street last week.

THE 1952 BUSINESS EFFICIENCY EXHIBITION, which is to be held at Bingley Hall, Birmingham, from February 19 to 29, will be opened by Sir Walter Monckton, the Minister of Labour. Organized by the Office Appliance Trade Association, the exhibition will display the products of Britain's £40,000,000-a-year office equipment industry, whose exports in 1951 reached the record level of between £10,000,000 and £12,000,000.

Ferranti Foundry

Innovations in Mechanized Production

By V. C. Faulkner

A return visit to a foundry after the lapse of 19 years can be most interesting and informative, particularly when that foundry is a progressive one. It can illustrate most vividly the changes which have taken place within the industry in the interim. Such a foundry recently revisited was that of Ferranti Limited of Hollinwood, Lancashire. At the time of the earlier visit the present foundry premises had only recently been completed, but even then it was very fully mechanized, and in fact housed what was probably the most comprehensive continuous casting plant in this country at that time. Since the war considerable changes have taken place, the shops have been greatly enlarged, the melting plants re-sited and augmentea, and further strides in mechanization have been made. The foundry amenities, which even in those days were excellent and in advance of usual practice, have now been transferred to fresh buildings and suitably enlarged and modernized. These and other changes have rendered the earlier article quite obsolete and it is felt that a detailed description of the present layout at Hollinwood will be of general interest.

Before taking the reader in logical steps through the layout from the arrival of raw materials to the despatch of the finished casting, it would perhaps be of help to explain that the foundry may, roughly speaking, be divided into three sections. The first section comprises two completely mechanized continuous casting plants, producing large quantities of small accurate castings with an extremely high standard of finish. The second section comprises the machine moulding of heavier castings, to an overall box size of 72 in. by 44 in. with the attendant mould and sand-handling plant, and the third section comprises a jobbing foundry for the manufacture of still larger castings in small quantities up to an overall weight of about 5 tons. This foundry is served by a Sandslinger which again has its own mould and sand handling plant.

Stockyards

Fig. 1 shows the general layout of the stockyards, from which it will be seen that there is now a railway siding so that raw materials may be brought direct for unloading beneath a Semi-Goliath crane with a lifting capacity of 3 tons. Electro-magnet, mechanical grab, and hook lifts (shown in Fig. 2) are provided. A series of substantial brick bins, reinforced and cemented, are provided for the reception of pig-iron, scrap and coke.

The coke wagons are emptied by grab, and pig-iron handled by electro-magnet is first dumped in front of a pig-breaking machine, as the long-established practice in this foundry is to reduce the pig to as small size as is practicable. This is helpful in charging, as some of the cupolas are of small diameter and it further enables a more accurate charge to be formulated, an important point where close control of the metal is to be maintained. Service bins on the cupola platform are filled direct by the crane, *via* a chute which is incorporated in its construction. Subsequently five- and ten-cwt. skips suspended from a monorail and each having a dial-weighing machine interposed between it and the hook, are loaded from the service bins according to a predetermined schedule. A tipping arrangement then allows the contents to be charged down chutes into the various cupolas.

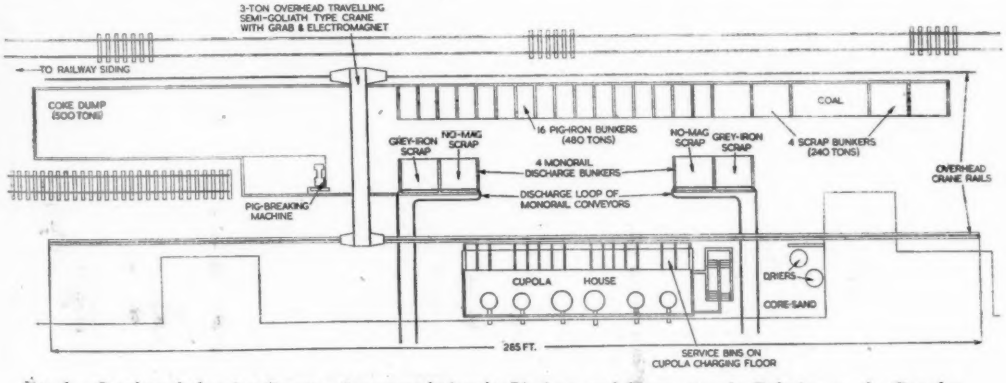


FIG. 1.—*Stockyard showing Storage Accommodation for Pig-iron and Scrap, etc., in Relation to the Cupolas.*

FIG. 2.—*" Semi-Goliath" Crane, capacity 3 tons, serving the Stockyards.*

A view of the cupola stage is shown in Fig. 3. Coke in turn is weighed and charged in the same manner.

Melting Plant

There are now installed in a single row six cupolas, four of them of 2 ft. and two of 3 ft. internal diameters. These furnaces are so arranged that only the spouts project into the foundry, with the object of reducing the amount of heat radiated into the shops, and also to ensure that if there be any carbon monoxide it is well diluted by ample access of fresh air. Half the cupolas work on alternate days, the smaller ones catering for the continuous casting plants and the larger ones for the rest of the foundry. Each pair of cupolas is fed by a double breeches blast-pipe arrangement emerging from two fans so that there is complete duplication in the event of a breakdown. In the daily patching of the cupolas, it is of interest that the contours are not made parallel, but made to follow that formed after a day's blow. This practice, not always followed by other foundries, leads to a considerable saving in patching material. Some experiments in water-cooling are in hand, which are again giving indication of considerable saving in furnace maintenance.

A considerable amount of metal inoculation is done in this foundry, and an item of interest above each tapping spout is the installation of an electronic apparatus for the addition of inoculants to the flowing metal. Fig. 4 shows an illustration of this equipment. (*A*) is a light-sensitive cell focused on the tapping hole, (*B*) is an amplifier which at the emergence of molten metal " triggers off " the electric vibrator (*C*) which in its turn induces a flow of the inoculant into the molten stream. This device, by elimination of the possibility of human error, has done much to ensure closer metal control. The furnace plant is melting some 125 tons per week, a high proportion of which is Nomag, the non-magnetic austenitic iron pioneered by the Company. This is a material which often requires to be pigged down and remelted before use. It is interesting to note that a nodular Nomag iron is new being made and the trademark NOduMAG has been registered in this connection. Some samples inspected showed it to have considerable ductility and strength.

A safety precaution on the cupola plant, not always observed by foundries in general, is that the charging hole is covered over during patching operations to prevent accidents from falling bodies. It may appear that for a highly-mechanized foundry the cupolas employed are rather small. The reason for this is that the Ferranti Company have achieved an outstanding reputation for the supply of true-to-dimension, thin-walled castings. Some of these castings have scarcely any taper and most dimensions can be held within five thousandths of an inch. These figures are comparable with the average run of die-castings.

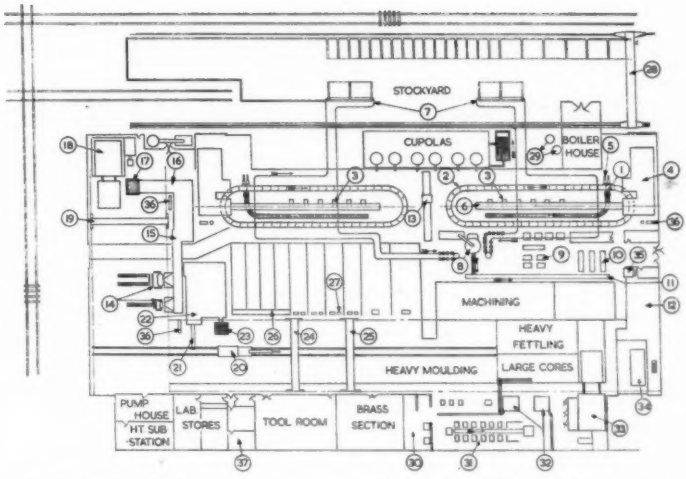
Handling the Metal

A glance at Figs. 5 and 6, a general plan, and flow sheet, shows that the servicing of the mechanized plants with molten metal is quite simple, the conveyors being arranged to come close by the furnace spouts. On the other hand, the supply of the heavier mechanized foundry and the jobbing

FIG. 3.—*Charging a Cupola by Tip-up Skip suspended from a Crane Weighing Machine (Dial-type).*

FIG. 5.—*Layout of Ferranti Foundry, showing the Distribution of Main and Subsidiary Sections:*

1—Knock-out Grid.
2—Power-driven Pallet Conveyor.
3—Six Moulding Machines.
4—Sand Preparation and Reclamation Plant.
5—Pneumatic Push-off Rams.
6—Overhead Belt to Sand Hoppers.
7—Overhead Pendulum Conveyor.
8—Rotary Shotblast Machine.
9—High-speed Grinding Machines.
10—Dressing Benches.
11—Discharge conveyor from Shotblast.
12—Packing and Despatch.
13—10-ton Crane for Ladles.
14—Herman Moulding Machines.
15—Sand Conveyor above Herman Machines.
16—Sand Plant for Herman Machines.
17—Knock-out for Herman Moulds.
18—Mould-drying Stove.
19—3-ton Overhead Crane.
20—Travelling Sandslinger.
21—Discharge Belt feeding Sandslinger.
22—Sand Plant for Sandslinger.
23—Knock-out for Heavy Bay.
24—3-ton Overhead Crane.
25—10-ton Overhead Crane.
26—Bench-moulding Station.
27—Small Moulding Machines.
28—3-ton Semi-Goliath type Crane.
29—Core-sand Driers.
30—Core-sand Preparation.
31—Coremaking Section.
32—Continuous Core-ovens.
33—Large Batch-type Core-oven.
34—20-ton Weighbridge.
35—10-cwt. Weighing Machine.
36—Automatic Electric Control Panels.
37—Administrative Offices.



foundry located on the opposite sides of the building, created something of a problem, if metal was to be delivered with the minimum of delay and loss of heat. Ladles of up to 5 tons capacity are placed in a pit in front of the two larger cupolas. This pit is provided with covers for such times as it is not in use or, alternatively, it may be desired to catch metal from the furnaces in hand ladles. Ladles are lowered into the pit by overhead crane and when full are lifted and placed on a specially-designed "Greenbat" electric truck, shown in Fig. 7. This truck can carry 5 tons of molten iron in complete safety at speeds up to six miles per hour to any location in the foundry. It avoids the delay of moving by transfer car from bay to bay and on reaching its destination the ladle is quickly picked up by a 10-ton crane for pouring. For the two continuous casting plants, 40-lb. hand ladles are used, the men standing on the platform mould conveyor whilst pouring. A number of trials of pouring monorails have been made from time to time, but difficulty has always been experienced in arranging these to move smoothly on a curved track. Prototype tests of a trolley of the company's own design have just reached satisfactory completion and work is now in hand to install a new monorail system which it is confidently expected will overcome previous difficulties, and at the same time remove all manual effort in lifting metal.

FIG. 4.—*Electronically-controlled Apparatus for adding Inoculants at the Cupola Spout.*

Sand Systems

For the continuous casting plants, natural sands are used compounded of Mansfield red with a small admixture of Warrington sand. The management is generous in the addition of new sand, but so are all foundries which have a reputation for making castings with a fine skin. Fortunately, there is still ample space available on the land surrounding this foundry for tipping discarded sand. Moulding sand is prepared in two distinct units, each serving one of the continuous casting plants. Its general properties are 4.5 to 5.5 per cent. moisture, 5.5 to 7 lb. per sq. in. green-strength, and an A.F.S.

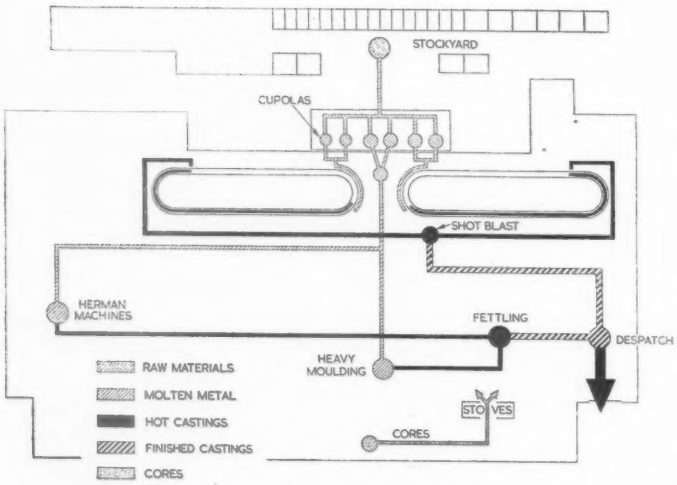


FIG. 6.—*Flow Sheet showing the Interconnection between Different Operations in the Ferranti Foundry.*

permeability number of 15 to 25. Sieve tests give the following grading:—

30's	.. ..	0 to ½ per cent.
60's	.. ..	9 „ 11 „
150's	.. ..	48 „ 55 „
300's	.. ..	25 „ 35 „
300+	.. ..	2 „ 4 „

There are two other sand-preparation plants in operation, one serving the Sandslinger and the other the two fairly-heavy-duty moulding machines previously mentioned. In both cases, a synthetic sand is used, the basis in the case of the former being Chelford coarse, and for the latter a mixture of Chelford fine and coarse sands. Cores are made with Southport dune sand, and from Fig. 1 it will be seen that this is stored quite close to the sidings where it is delivered and dried nearby in a simple Fordath plant, and then transported across the foundry to the core shop.

FIG. 7.—*"Greenbat" Electric Truck for Transporting up to 5-ton Capacity Ladles.*

Return Sand System

The main source of sand for the mechanized plants is, of course, that passing through the knock-outs, which are of the Sterling type, size 30 in. by 30 in. Here the sand falls through 1½-in. gratings on to a 22-in. wide belt running between 26-ft. 4-in. centres. Over this is an Overband-type magnetic separator for the removal of tramp iron. This conveyor discharges on to a belt running at right-angles which also picks up new red sand from an underground hopper into which fresh supplies are conveniently tipped direct from the stockyard. This conveyor in its turn discharges into the boot of a fast-running bucket elevator, the speed of which tends to keep clean by centrifugal force the 15-in. by 7-in. malleable buckets. The elevator feeds a rotating hexagonal sieve provided with a ¼-in. mesh. This figure is a cardinal one in the operation of a mechanized plant, as often one finds in use a quite coarse mesh, resulting in a deterioration in the quality of the castings as compared with the hand-made product. On leaving the sieve, the sand falls into a 40-ton hopper, this large capacity leaving plenty of time for cooling to take place. It has been found desirable to equip the hopper with vibrators, as without them the sand supply is confined to a central "pipe." Why this should be so is still a mystery to the writer, as vibration usually tends to consolidate. However, an ounce of practice is worth a ton of theory!

The sand from the hopper is removed by a belt 30 in. wide running between 14-ft. 6-in. centres and feeding direct into a standard 20-ton Foundry Equipment mill with central discharge. Water and coal-dust are added here, the latter from a small hopper by means of an 8-in. wide belt. Adjustments to the water addition are made according to the readings given by a continuously-operating moisture meter of Ferranti design taking readings on the flight conveyor over the moulders' hoppers. The moulding sand falls into the boot of a second belt and bucket elevator of 20 ft. height, which in turn discharges into a squirrel-cage type disintegrator which finally aerates the sand and feeds it on to a 24-in. wide belt, 98-ft. centres, spanning the line of the moulding machines. From this belt, sand is ploughed off to fill conical hoppers with clam-shell closures above each machine. The ploughs are operated from an overhead gantry by the plant attendant, who at the same time takes care of the moisture additions as mentioned

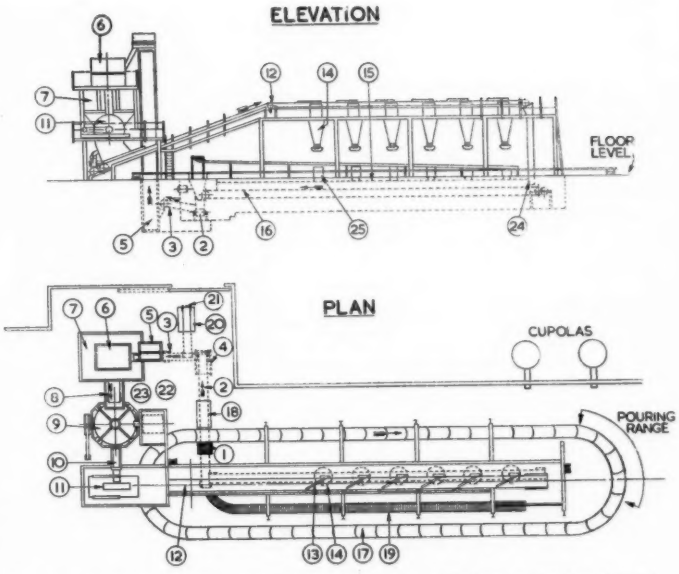


FIG. 8.—*General Arrangement of one Continuous Casting Plant.*

1—Knock-out Grid.
2—26-ft. Knock-out Sand Belt.
3—Belt to Elevator for Knock-out Sand, Spillage Sand and New Sand.
4—Overband Magnetic Separator.
5—38-ft. Return-sand Elevator.
6—Rotary Screen.
7—40-ton Storage Hopper.
8—Feeder Belt to Mill.
9—Sand Mill.
10—Elevator for Milled Sand to Disintegrator.
11—Disintegrator.
12—Belt for Conditioned Sand to Machine Hoppers.
13—Straight Plough.
14—Conical Hoppers.
15—Spillage Grids in Floor.
16—71-ft. Belt for Spilled Sand.
17—Mould Conveyor.
18—Pneumatic Pusher.
19—Roller Conveyor for Empty Boxes.
20—Hopper for New Sand.
21—Belt for New Sand.
22—Coal-dust Hopper.
23—Belt for Coal-dust Addition.
24—Chute for Excess Sand.
25—Six Moulding Machines.

previously. Any sand not taken up by the moulders' hoppers drops down a chute on to the beginning of the underground spillage belt conveyor. This is 70 ft. long by 22 in. wide and takes the spillage from the moulding machines (which stand on a continuous grating) to the knock-out for return to the system. Every night, the moulders' hoppers are completely emptied, as not only does this go far to prevent sticking, but it effectually prevents the use of too dry a sand the first thing in the morning.

Sandslinger Supplies

The sand preparation for the motive-type Sandslinger is rather different. Sand is first returned *via* a 78-in. by 72-in. Sterling vibrating knock-out grid. It passes by an Overband-type magnetic separator up a bucket elevator and through a $\frac{5}{16}$-in. mesh rotary sieve into a black-sand storage hopper, which discharges at will into the boot of a bucket loader. Additions of bond (in this case Fulbond), etc., are made here and the bucket discharged into a 6-ft. batch-type Pneulec mill. Moisture additions are controlled by water meter and mixing is conducted underneath a hood to prevent dust being ejected into the foundry. The mill discharges *via* a bucket elevator on to a conveyor, whence it is ploughed off into two circular hoppers having a total storage capacity of 80 tons. Here the ploughs are operated electrically so that as soon as the first hopper is full the plough is raised and sand then discharges into a second hopper. These hoppers have rotary tables from which the sand is ploughed off on to a 24 in. wide by 46 ft. long conveyor belt running at such a speed that the 10-ton hopper on the Sandslinger may be replenished in 2 min.

Heavy-machine Sand System

The fourth sandplant serving the heavy moulding machines is somewhat similar in design to the one just described. Here again moulds are knocked out on a 78-in. by 72-in. Sterling vibrating knock-out The sand is then carried by a 22-in. wide conveyor belt with an overband magnetic separator, to a bucket elevator discharging into a $\frac{1}{4}$-in. mesh rotary sieve which in its turn discharges into a 10-ton capacity hopper. A similar Pneulec batch-type mill with bucket loading and disintegrator

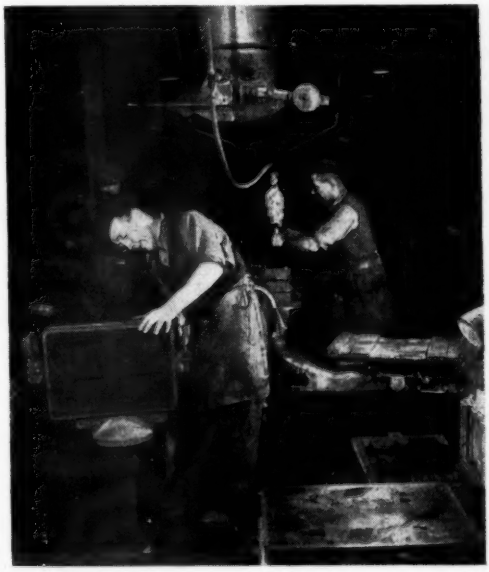


FIG. 9.—*Close-up of one of the Moulding-machine Stations in the Continuous Casting Plant.*

Ferranti Foundry

discharge feeds the prepared sand into a bucket elevator discharging on to an overhead conveyor serving in its turn the two moulding machine hoppers. Discharge is effected by ploughs operated from ground level as desired.

Moulding Plants

As will be seen from the general arrangement drawing Fig. 8, the two continuous casting plants only differ in that one is right-handed and the other left-handed with respect to the melting plant. They each use for mould manufacture a row of six Osborn-type pneumatic jolt-roll-over machines, modified in certain respects to the Company's requirements and experience. In general the modifications are designed for quicker maintenance in the replacement of worn parts and to ensure perfect levelling of the lower mould table. Osborn-type pneumatic mould-clamps are fitted, and over each machine a pneumatic flat rammer is suspended from a spring-loaded trapeze for firming-off the backing sand. Considerable attention has been given to the work study of these machines and a quite nice gadget is provided for sliding off the bottom half-mould on to a table for, if necessary, coring-up and then lowering down to the mould-conveyor level. In practice, however, the operators prefer in most cases to keep the table permanently at the lower level, considering that the slight extra physical effort involved is justified by the additional speed attained. Frequently, more than four hundred complete moulds per day are produced from each machine. A close-up of one machine in operation is shown in Fig. 9.

The top-part is placed edgewise on a rotatable stool, which can be seen in Fig. 9. This nicely positions the mould for cleaning up before mould assembly. Two machines produce both parts of the mould simultaneously, a team of three men being employed. One transfers the empty boxes from the return mould conveyor to the machines and admits the sand from the hopper. The second operates the machine controls and assists in the removal of the box-parts at the end of the cycle, whilst the third cleans, cores, and closes the mould which is then pushed on to the mould conveyor to be clamped by an excellent spring device (shown in Fig. 10), prior to casting. For the casting operation the pourers stand on the mould conveyor as previously mentioned, and as shown in Fig. 11. The sections cast are in general so

FIG. 10.—*Spring Device serving as both Box Clamp and Weight for Moulds.*

light that there is need neither for a fume hood nor prolonged cooling. The mould conveyor consists of cast-iron palettes forming the tops of wheeled bogies, linked by a continuous chain. The speed is variable from 8.4 to 20 ft. per min. and the conveyor has an overall length of 225 ft.

(To be continued)

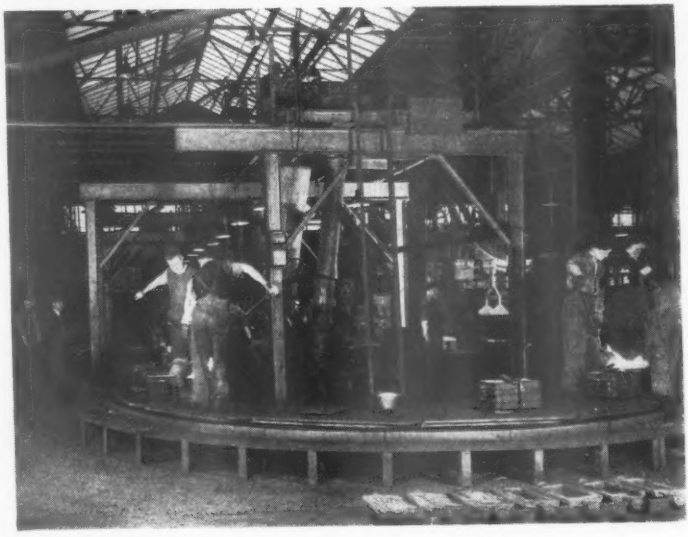


FIG. 11.—*Pouring taking place with Operators standing on the Conveyor.*

Case for Cast Iron

The following statement was issued by the Council of Ironfoundry Associations at a Press conference last week:—

Nomenclature

Some confusion of thought exists amongst the public regarding the title "The British Iron and Steel Federation," as it is thought that this body represents all the iron interests, including foundries making cast-iron products. This is not the case, as the Council of Ironfoundry Associations is an entirely separate body with no affiliations whatsoever to the Federation. The "iron" referred to in the Federation's title does not include the cast-iron industry, but only iron for steelmaking. The Government has recognized the right of the C.F.A. to represent all cast-iron interests, as in 1945 the Joint Iron Council (in which the Council of Ironfoundry Associations is a partner) was asked by the Government at that time to write a report on the "iron industry."

It has been thought advisable to point out the facts, as many people may consider the dispute which has arisen between ironfounders and the British Iron and Steel Federation is entirely a domestic affair. On the contrary, it is a matter of national concern that the difference of opinion between the two industries should be sensibly resolved.

Campaign Against Iron Foundries

During the past three weeks, a number of statements have appeared in the Press regarding the failure of the steel industry to reach its target of 16 million tons production in 1951. In practically every instance, ironfounders have been blamed for this failure, on the grounds that they used more than their fair share of raw materials (pig-iron and scrap). These statements appeared with such regularity that it became obvious that the founders were being subjected to a "campaign." The British Broadcasting Corporation, on January 25, broadcast a statement from the British Iron and Steel Federation, when a similar charge was repeated, together with a suggestion that it would be reasonable to limit ironfoundry output to the 1950 level (3¼ million tons). The Council of Ironfoundry Associations replied to this statement on January 26, pointing out that in 1951 ironfounders' stocks were reduced by 180,000 tons of pig-iron, and foundries were now working on a hand-to-mouth basis. The founders denied the right of another industry, as represented by the British Iron and Steel Federation, to define, or attempt to define, the rate of their expansion, and so interfere with their responsibility to industry and the general public.

During 1951, the import of scrap into this country for steelmaking fell by 1,340,000 tons (compared with

TABLE I.—*Production of Grey-iron and Malleable Castings, 1948 to 1951, and Details of the Main Fields of Consumption.*

Year	1948.		1949.		1950.		1951 (nine months).	
	Tons.	Percentage of total.	Tons.	Percentage of total.	Tons.	Percentage of total.	Tons.	Percentage of total.
Main fields of consumption:—								
1. Building and municipal (pipes, gutters, manhole covers, baths sanitary goods)	206,205	6.28	236,275	6.97	255,671	7.33	192,137	6.90
2. Cooking and heating apparatus, including radiators	207,843	6.32	207,591	6.12	227,829	6.53	184,036	6.61
3. Other domestic appliances	15,573	0.47	12,801	0.37	15,322	0.44	12,465	0.44
4. Pipes and fittings for gas, water, sewage, etc.	491,714	14.97	545,253	16.09	572,197	13.54	439,813	15.70
5. Coal mining, quarry, clay and cement plant	63,473	1.93	61,962	1.82	56,204	1.61	45,167	1.62
6. Gas production	38,227	1.01	34,284	1.01	34,587	0.99	25,779	0.92
7. Electricity generation and distribution	98,015	2.98	100,387	2.96	95,060	2.72	80,911	2.90
8. Motor-car and cycle industry	214,523	6.53	215,748	6.36	269,726	7.73	217,348	7.84
9. Railway equipment	316,405	9.63	321,799	9.49	277,645	7.96	244,297	8.77
10. Shipbuilding and docks	120,925	3.68	115,053	3.39	102,878	2.95	80,472	2.92
11. Prime movers (turbines, engines) for land use, and transmission machinery	92,852	2.82	102,439	3.02	115,540	3.31	96,221	3.09
12. Boiler-house plant for industry, etc.	72,880	2.21	74,687	2.20	72,911	2.09	55,709	2.00
13. Agriculture and food processing	194,805	5.93	178,033	5.25	198,342	5.69	160,918	5.78
14. Machine-tools	175,575	5.34	179,813	5.37	180,257	5.16	148,916	5.35
15. Textile machinery	157,890	4.80	146,845	4.33	134,165	3.87	107,535	3.89
16. Valves, pumps and compressors	46,391	1.41	60,623	1.78	70,731	2.02	59,511	2.13
17. Chemical plant	24,502	0.74	26,865	0.79	27,367	0.78	19,730	0.70
18. Ingot-moulds for steel and non-ferrous metal manufacture	302,580	9.21	318,339	9.39	321,647	9.22	251,050	9.02
19. Iron- and steel-works plant and rolls for mills	88,097	2.68	135,092	3.98	131,584	3.77	100,039	3.59
20. Cranes and conveyors for industry, transport, etc.	32,587	0.99	34,465	1.01	36,302	1.04	27,653	0.99
21. Printing and paper machinery	22,074	0.67	23,151	0.68	29,006	0.86	23,398	0.84
22. Balance (general engineering and jobbing castings)	259,304	7.89	256,616	7.86	261,928	7.51	204,862	7.36
Total production	Tons. 3,283,901		Tons. 3,388,121		Tons. 3,486,892		Tons. 2,782,977	
Malleable only	125,119		120,447		129,511		106,229	
Ingot steel output	14,877,000 tons		15,553,000 tons		16,293,000 tons		12 months ending December 31, 1951. 15,638,000 tons	
Total ironfounding labour force (operatives, clerical and management) at end of year	149,981	21.898 tons per man-year	146,211	23.172 tons per man-year	150,329	23.195 tons per man-year	151,919	

F

Case for Cast Iron

the previous year—a British Iron and Steel Federation figure). If this figure of 1,340,000 tons is compared with the extra amount of both pig-iron and scrap used by the iron foundries during that year (237,000 tons), one begins to see that the failure of the steel industry to reach its "target" is principally due to the shortage of foreign scrap, and not, as alleged, the increase in the amount of iron used by the founding industry, which amounts to only one-sixth of the decline in imported scrap. Statements in the Press have failed to draw attention to this position; nor has any reference been made to the large reduction effected in the stock position at the foundries of pig-iron (180,000 tons), which is a considerable figure when set against the estimated output figure of 3¼ million tons for 1951.

Proposed Substitution of Steel Sheet

The most objectionable feature of the attack on the founding industry from the national point of view has been the suggestion that because sheet steel is much lighter than iron castings, ironfounders were much more wasteful in the use of pig-iron and scrap than the steel industry. The instances quoted include baths, rainwater pipes, gutters and manhole covers. The sort of fallacious reasoning exhibited is shown by:—

(1) In the case of rainwater and soil-pipes and gutters (of which 103,000 tons were made in 1950), there is at the present time a prohibition in galvanizing owing to the world shortage of zinc. As regards enamelling, we know of no available capacity to be found in this country for processing 25 million pieces of these goods, a large proportion of which are 6 ft. long.

(2) Pressed-steel baths were produced in this country in the early post-war years, production was however discontinued some two years ago because public demand proved that the cast-iron bath is far more satisfactory both for the home and export markets, (over 125,000 cast-iron, porcelain-enamelled baths were exported in 1951 representing approximately 25 per cent. of the total production). Any attempt to substitute sheet steel would certainly endanger goodwill in the export markets and assist Continental suppliers, who are keen competitors at the present time.

Substitution Would Cause Dislocation

Apart altogether from these technical reasons, ironfounders are convinced that an attempt to substitute steel sheet for iron castings on any scale—and to be effective it would have to be on a large scale—would cause acute dislocation in both the sheet fabricating industry and ironfoundry industry, to say nothing of the engineering problems which would have to be solved first. Would it be wise at the present juncture to attempt to use steel for these domestic or semi-domestic purposes when America is placing a million tons of steel at our disposal? Moreover the Chancellor of the Exchequer has made it clear that the use of steel for such articles in this country is to be drastically restricted, and in view of this decision, it is difficult to see how these suggestions for substitution could be carried into effect even if it were possible.

Essential Castings Demands

The founders' case rests mainly on the fact that the small expansion which has taken place in the last two or three years is due mainly to increased demand for cast-iron products for the housing programme—the most important and pressing of social needs—railways, machine-tools, textile machinery, the motor industry and agricultural implements, all of which make a most important contribution to the export drive. Ingot moulds for the steel industry take over 9 per cent. of the total output. It will be seen that the maximum effort is concentrated on industries which are essential for the economic recovery of the country, and to cut down raw materials has the effect of interfering with such effort. It is no exaggeration to say that taking into consideration the difference in size of the iron-founding industry compared with the steel industry, the service founders are rendering to industry generally is equally important. Details of some of the main end-uses for cast-iron products and tonnages involved are given in Table I.

Improved Technique

By scientific research and exact control, the ironfounder can make a cast iron to-day almost three times as strong as the material produced 25 years ago. At the same time, the actual amount of iron used in the various products has been considerably reduced as a result of improved design and production techniques. As an example, 20 lb. of metal has been saved on the weight of a cast-iron bath. Very naturally the general tendency is to use less metal wherever possible.

It has been stated that most countries use fewer iron castings in proportion to steel sheet than we do, and this fact is being used against the iron foundries to prove that their expansion is against this trend, and consequently is at the expense of the steel industry. In the case of Europe, standards of building generally are much lower than in this country, and workers' houses over wide areas are devoid of baths, gutters and fall-pipes. The bigger ratio of iron to steel used in this country as compared with America is influenced by a number of varying conditions, one of which is the difference in manufacturing techniques. America, because of mass demand, can afford the initial high cost of dies for steel stampings and forgings from which they produce in great quantity. In Britain, where the number of such products required is much smaller, it is more economical and practical to produce iron castings.

At a time when the steel industry is in process of denationalization, the Council of Ironfoundry Associations feels it essential to emphasize the necessity of maintaining their continuing right to obtain adequate raw materials to meet the nation's demand for cast-iron products. The Council intends to reply vigorously to the campaign against them with this objective in view.

I.B.F. Branch's New Name

At a recent meeting of the Council of the Institute of British Foundrymen, it was agreed that the Middlesbrough branch should in future be known as the Tees-side branch. The Middlesbrough branch was formed 25 yrs. ago, mainly by members from the Newcastle branch who lived in the Middlesbrough area. The branch has grown considerably in numbers and in importance and its members are spread over Middlesbrough, Stockton, Thornaby, Darlington and many other towns, in the district. The new name, Tees-side branch, is therefore more representative of the geographical area in which the members reside and work.

METALLURGISTS from works and laboratories in all parts of Britain will attend a five-day course at the recently inaugurated post-graduate school of physical metallurgy at Sheffield University, commencing on March 31.

Brains Trust Meetings

Meetings at which a panel of knowledgeable members answer questions submitted by the audience after the manner of the B.B.C. feature "Brains Trust" are a feature of this year's programmes of several branches of the Institute of British Foundrymen. These meetings form a popular basis for discussion of a wide range of subjects of interest to foundrymen and are invariably well attended. Below are printed reports of such discussions taking place, under the auspices of the West Riding of Yorkshire branch and the East Anglian section of the Institute.

Amongst questions posed and discussed at the West Riding branch "Brains Trust" meeting held recently were the following. The question-master was Mr. F. K. Neath, B.SC., and the panel consisted of Mr. Johnson, Mr. Sutcliffe, Dr. Fell and Mr. Simpson.

Does the Brains Trust consider that hard-wood flour gives superior results to soft-wood flour?

MR. JOHNSON: If anything, the soft-wood flour is slightly better than the hard-wood but there is nothing much in it. The soft-wood is cheaper.

What principles contribute to the success of pencil gating. On what type of casting is the method used and why is it not used on most types of small and medium-size castings?

MR. SIMPSON: Pencil gating is a good proposition in preference to trying to run a casting with one or even two ingates; it keeps out the dirt to a considerable extent.

A MEMBER: If you have pencil gating all the way round a bush casting made vertically the scum is broken up and washed to the top.

MR. JOHNSON: Pencil gating delays solidification at the top and yet allows of some solidification whilst the casting is still being poured. Less final feeding is required. The object of using several pencil gates is to spread out the metal more evenly. It is essential to use really hot metal or splashing will result.

MR. NEATH: Many years ago, when Mr. Ronceray came over from France, he gave a lecture on pencil gating and the main point he mentioned was that the casting was run through the small pencil gate, resulting in solidification of the lower portion of the casting while the top was still being poured. Many peop'e had tried the method, which had applications for some castings and not for others.

Metal Cost at the Spout

What factors should be taken into account in determining the cost of metal at cupola spout?

MR. JOHNSON: There has to be taken into consideration the price of the raw materials, the coke and the melting loss and the wages of the furnace attendants. If there be included in the charge a certain amount of returned scrap, it is difficult to know at what price that should be charged, or whether it should be charged at the price at which it would be sold, which of course would be much lower than when going into the foundry. One could argue that its real intrinsic value is only the market value. Then there is, of course, to be added the cost of the fettling of the cupola.

MR. NEATH: Assuming you have 100 tons of runners and risers in the first week of January and it is charged into the cupola and the foundry makes some castings resulting in some further scrap, on December 31 there may still be the same tonnage of runners and risers in circulation. Some metal is lost in melting and some is taken away with sweepings, etc., to the rubbish tip, but normally scrap is a circulating commodity and only the actual melting and accidental loss is consumed in making castings.

MR. SUTCLIFFE: The Productivity Team visiting America reports the scrap as circulating all the time.

A MEMBER: As soon as a foundry becomes efficient, it should produce less scrap and more pig-iron has to be used to replace it.

MR. SIMPSON: This applies more to a foundry producing large castings. A 15-ton job may require 18 tons of metal to cast it, but it does not apply in every foundry. In a foundry making small castings the scrap ratio will not be as large.

MR. JOHNSON: As long as one system is adhered to it will be satisfactory.

A MEMBER: For every ton of good castings you still want a ton of good pig-iron to replace it.

MR. HAMMOND: From a costing point of view it is essential that scrap that originates in the foundry should be costed at the same price as outside scrap, because the figure that is of interest to the costing department is the price of metal in the ladle. Each individual job that is credited has a certain amount of scrap presented to it. The cost at the spout should be the total cost of metal in the ladle, and then the amount of scrap should be credited against the cost of the metal in the ladle.

MR. SIMPSON: If one deals with one particular firm and if one returns to them any scrap from their castings they will accord full value for it but they will not accept mixed metal. The purchaser is the loser if scrap is not segregated.

Sandslinger Efficiency

A very large number of shallow moulds are required about 2¼ in. to 3 in. deep. Complete mechanization could be envisaged. What is the opinion of the Brains Trust regarding the efficiency of a Sandslinger for ramming these boxes?

A MEMBER: There is in operation in this country a plant used for producing small castings from a Sandslinger. The production obtained is fairly good but is not better than normal machine output.

A MEMBER: The trouble is that with a shallow mould barred boxes must be used, and a Sandslinger does not ram underneath the bars. The barred box appears to be quite a problem in

productivity. The Sandslinger is by far the best tool for filling-in moulding boxes of any appreciable size.

MR. JOHNSON: The Sandslinger is for the rather heavier boxes except in special instances. For the bigger boxes—from 12 to 24 in. deep—there are suitable moulding machines, but they are relatively slow in working.

MR. SIMPSON: A textile frame mould is a case for Sandslinger use; it cannot be jolted satisfactorily.

Special Core-binder

Do the members of the Brains Trust know of a core-binder or any method whereby small cores can be made and placed on hot-plates and stacked to dry without packing them in core-drying oven?

MR. JOHNSON: *Such core-binders have a very limited application. In a similar case boiled linseed oil was used; probably dextrine is used as well.

MR. SIMPSON: The resin field might yield results.

MR. NEATH: Cores about 2 in. dia. made in one recommended material had not dried after 24 hrs.; they dried on the surface and seemed satisfactory, but inside they were still damp.

MR. JOHNSON: The ideal is, of course, to have a high-frequency baking oven.

MR. NEATH: This system works well. From personal experience one core went through in three minutes, using a resin binder.

Do the Brains Trust feel that the recommendations of the productivity team have been or are being adopted in this country?

MR. SUTCLIFFE: One of the main points suggested is mechanization and this is rather difficult for British foundries to take up, in view of power cuts, etc.; but only part of American success could be attributed to mechanization.

MR. SIMPSON: The more modern foundries are trying out the recommendations, but the main point is incentive and the men's ability to work. When I was in the States in 1920 the moulders started work at 4 a.m. but they finished at 2 p.m.

MR. JOHNSON: The Productivity Team's report is directed mainly towards the old-fashioned type of foundry, so that they will become modern. It is difficult to say just how many of the recommendations have been carried out, but to judge by the orders being handled by the firms supplying mechanized plant, etc., there must be much mechanization in progress.

MR. NEATH: Productivity in the steel foundries has gone up 20 per cent. since the team went to America. The steelfounders are a smaller group and are very well organized; they have gone round amongst themselves and carried out what they saw. When they got to America they saw what could be done. Even in the small foundries in America they aim always to increase productivity, if they want to move something they use a wheelbarrow, not just any wheelbarrow but one specially made for the job. They find labourers to do auxiliary work to keep the skilled moulder at his particular job. Quite a lot of other matters in America were germane, including incentive provision and the shops being open in the evening so that one could spend money.

Cement Moulding

What are the future possibilities of the so-called cement moulds. It may be possible to produce quite a large number of castings from the same mould, whereas a sand mould was limited to one, but that of course was limited by the life of the mould and sand is very much less expensive than cement.

A MEMBER: You will find that the Chinese used to make their coins in cement moulds.

MR. G. JONES: Cement moulds are very good where the metal does not come into contact with them too much. I have seen, about 15 years ago, 18 or 20 block cores of approximately 30 in. sq. and 12 in. deep, made in ordinary cement and not knocked-out in three years. The firm cast 16 to 20 a day, but the metal did not come into contact very much with the cement.

MR. SUTCLIFFE: To make more than one from the same mould, it would have to be a very simple casting. The contraction of the casting in the mould is liable to destroy the mould face. I think there would be narrow limits as to what could be made in such moulds.

MR. JOHNSON: As Mr. Sutcliffe so rightly stated, the success of the process is entirely dependent on the type of casting. Silicon ester has been used for a very similar purpose. Where jobs are to, say, 50 off, and not really worth the expense of a metal die, they are produced very satisfactorily. It is very simple to make the mould; the mix is poured on and vibrated and produces a very accurate reproduction; after half an hour, the impression can be put in the oven. It is a very much cheaper process than making a metal mould, but the metal mould has advantages as regards reproduction of detail.

What are the relative advantages and disadvantages of elevator buckets and inclined belts on mechanical sand-treatment systems.

MR. JOHNSON: The only advantage of a vertical elevator is that it saves space.

MR. NEATH: Whilst inclined belts do take up a lot of room, they are much more satisfactory and give less trouble. Bucket elevators can be made to work if properly designed and looked after. A bucket elevator in my shop which has been working 16 years has given very little trouble.

A MEMBER: A bucket elevator run at a very fast speed will eliminate sand adhesion.

Prospects for Nodular

What are the prospects for nodular cast iron?

MR. JOHNSON: Experience of the production of nodular iron has shown that with suitable precautions in selecting raw-materials and suitable heat-treatment its properties are such that it is capable of replacing the majority of blackheart malleable castings and also some steel castings—particularly where steel has been used because the

* See "Core-making at Coneygre," by A. R. Parkes, printed in the JOURNAL, June 9, 1949.—EDITOR.

section thickness is too heavy for malleable, due to the difficulty of avoiding primary graphite. Nodular can be cast into very thick sections with very little falling off in properties. Under practical foundry conditions, on a semi-production scale, I have made nodular iron with properties, including shock-resistance, superior to those of normal blackheart malleable, and it seems there could be most scope for its development in this direction. However, at the present time, it is unlikely that nodular-iron castings, can be made cheaper than blackheart malleable castings due mainly to the high cost of the addition alloy and therefore this replacement is unlikely to occur to any appreciable extent. Where it can replace steel, the comparison will be more favourable.

With regard to nodular's future, it is difficult to predict, but it seems to me to be largely dependant upon economies. It may be that if the cost cannot be much reduced it will, as other improved materials have done in the past, just take its place alongside the existing materials, rather than replace any of them. I have been able to economize, to some extent, by using a basic-lined cupola to obtain low-sulphur metal. The lower the sulphur, the lower the amount of magnesium alloy needed; there are also practical difficulties which tend to put the cost up rather, by increasing the risk of scrap; and the biggest is in avoiding slag-inclusions, for there is a fair amount of slag produced by the treatment and special precautions have to be taken to take care of it. These measures are not helped by the quite-appreciable drop in temperature during the treatment. It seems also that the magnesium in the metal is oxidized out by turbulence in the metal. You can pour quite clean-looking metal into a mould, but if your gating system is not good enough you are likely to get inclusions in the casting.

East Anglian Section

The " Brains Trust " meeting of the East Anglian section was held in the Lecture Hall, Central Library, Ipswich, on January 15, under the chairmanship of Mr. C. H. Kain. The other members of the panel were Mr. J. W. Gardom, Mr. J. L. Francis, Mr. B. Levy, Mr. W. L. Hardy, Mr. D. Carrick, and Mr. V. W. Child (president of the section).

Upwards of 25 written questions covering a fairly wide field were submitted, and very interesting discussions followed each question, some of which are given below. At this meeting only the consensus of opinion is recorded in the answers.

What in the " Brains Trust's " view has been the most effective contribution to the foundry industry for its betterment over the last ten or fifteen years?

It was generally considered that the implementation of the recommendations of the " Garrett Report " had been the major feature.

If in designing a patternshop, only five woodworking machines were to be installed, what sorts would be preferred?

Lathe, bandsaw, circular saw, pattern miller and sander were selected.

Some founders favour round feeders as opposed to square or rectangular feeders and vice versa. *Which does the team consider to be the most efficient?*

Much depends on the type of casting to be fed, but, generally, round feeders are more effective than square of the same cross-sectional area.

Does mechanization pay in a jobbing foundry? If not, what mechanical aids should be installed?

Wherever mechanization can be used it should be, particularly if the type of equipment installed eliminates back-breaking labour.

Technical Developments

Is it the Trust's view that technical development in the American iron and steel castings industry is more forward than our own, and if so, what are the reasons and the remedy?

The general reply was in the negative, the Trust considering that surface-finish, feeding methods and metallurgical control were of as high a standard, if not higher, in England than in the United States, but productivity was undoubtedly greater in America.

What precautions can be taken to ensure that oil-bonded cores are properly oxidized during baking? Cores giving maximum strength are known to fume badly in the foundry due to under-oxidation.

Generally, it was considered that oven design, standardization of cores, and full air-circulation were necessary if core-oils were to be adequately oxidized.

In a mechanized jobbing foundry, using modern feeding methods, should one favour the coremaker or the fettler when designing feeding equipment, i.e., *the use of intricate Washburn or knock-off cores, which make fettling easier but cause difficulties in the core-shop?*

The panel considered that, in general, the problem was an economic one, and whilst coremakers were more easily obtained than fettlers, the opinion was that any feeding techniques which speeded up the fettling operation were an advantage.

What dressing is recommended for chills used in the bottom of a mould to form a slot ¾ in. wide and 2 in. deep, there being 2 in. of metal all round the chills?

A number of dressings is available, the most popular being plumbago, shellac and sand, and aluminium paint.

At the close of the meeting, a vote of thanks to the members of the panel was proposed by Mr. L. W. Sanders, secretary of the section, and its adoption concluded the proceedings.

National Foundry Craft Training Centre

Managements who have in their foundries youths who are suitable candidates to attend the four-week training course at the National Foundry Craft Training Centre at West Bromwich, are asked to note that the next two courses will commence on the dates mentioned below. Applications to attend the courses should be addressed to Mr. R. Forbes-Baird, 117, Church Lane, Handsworth Wood, Birmingham, 20.

Term No.	Commence.	Terminate.	Course No.
35	10 Mar.	4 April.	4th
36	16 Apr.	9 May	1st

Personal

MR. E. E. INGLETON has been appointed works manager of the Yorkshire Engine Company, Limited, Sheffield.

SIR HENRY GUY, C.B.E., D.Sc., has been elected an honorary member of the Institution of Mechanical Engineers.

MR. HENRY FRANK HARDING JONES, chairman of the East Midlands Gas Board since 1948, has been appointed deputy-chairman of the Gas Council.

MR. RUPERT S. ALLEN, managing director of W. H. Allen Sons & Company, Limited, engineers and founders, of Bedford, is now convalescing after hospital treatment following a recent illness.

MR. G. BAKER, managing director of John Baker & Bessemer, Limited, Rotherham, has been installed president of Sheffield Society of Engineers and Metallurgists for the next two years.

AFTER 50 years in the service of Thomas Bolton & Sons, Limited, MR. DAVID ALLEN, foreman of the non-ferrous tube department at the company's Oakamoor (Staffs) Works, retired last week.

MR. C. B. SNODGRASS has been appointed general manager of Fusarc, Limited, Team Valley (Co. Durham), and has relinquished his post as works manager of its associated company, Quasi-Arc Company, Limited.

BRITISH ELECTRO METALLURGICAL COMPANY, LIMITED, Grange Mill Lane, Wincobank, Sheffield, announce that MR. T. POWELL, the general manager and director, has been appointed managing director of the company.

MR. WILLIAM BOND, has retired after being the secretary of Renishaw branch of the Amalgamated Union of Foundry Workers, an office he has held for over 50 years. He is succeeded by Mr. L. Tory, of Eckington.

MR. MAX KUNIANSKY, of the Lynchburg Foundry Company, has been honoured by the Gray Iron Founders' Society by the presentation of a "citation of merit" in recognition of his services to the foundry industry.

LIEUTENANT-COLONEL ARTHUR W. BURTON, managing director of the District Iron & Steel Company, Limited, Smethwick (Staffs), has assumed command of the 9th Staffs (West Bromwich and Smethwick) Battalion, Home Guard.

MR. J. W. WRAY, divisional chief engineer, International Combustion, Limited, Derby, is a member of the fuel conservation productivity team, which is on a visit to America. Mr. Wray represents the Engineering and Allied Employers' National Federation.

GLOUCESTER FOUNDRY, LIMITED, Emlyn Works, Gloucester, announce that Mr. F. B. Butler has been appointed general manager. Mr. Butler joined the company in 1931, and in recent years has held, successively, the positions of works superintendent and general works manager.

MR. GEORGE WOOD, chairman of Thos. W. Ward, Limited, Sheffield, is visiting Saudi Arabia where the company has a £3,000,000 contract for the construction of a road. He is accompanied by MR. H. W. SECKER, joint managing director, and Mr. G. S. WOOD, a director of the company.

THE GWELO FERRO-CHROME PLANT, in Southern Rhodesia, for which John Miles & Partners, London, are consultants to John Brown & Company, Limited, should be in the first stage of production by next May. It will produce high-grade low-carbon ferro-chrome.

Obituary

THE DEATH ocurred on January 26 of SIR REGINALD STRADLING, F.R.S., Dean of the Military College of Science at Shrivenham and former chief scientific adviser to the Ministry of Works. He was 60. In 1939 he was made Chief Adviser, Research and Experiments, at the Ministry of Home Security, a post which he held until 1944.

THE DEATH has occurred of MR. JOHN M. BAXTER, chief mechanical engineer of Sir William Arrol & Company, Limited, bridge builders, etc., of Bridgeton, Glasgow. He was 63, and had served the company for 37 years. He received his early training with Urquhart, Lindsay & Robertson Orchar, Limited, Dundee. Mr. Baxter was a member of the Institution of Mechanical Engineers, the Institution of Shipbuilders and Engineers in Scotland, and the Institute of Welding.

MR. W. G. GROOCOCK, who retired from the managership of the Birmingham works of the British Thomson-Houston Company, Limited. in 1941, died on January 25. He was actively engaged for most of his life on accurate and interchangeable manufacture, and he was an authority on limits. The author of many articles published in the technical Press, he joined B.T.H. in 1918, being appointed manager of the Birmingham works three years later. Mr. Groocock was 81.

HONORARY SECRETARY for 15 years of the James Watt Memorial Institute, Birmingham, the honorary secretary for 25 years and a past-president of the Birmingham Association of Mechanical Engineers, MR. WALTER HADLEY died in Birmingham on January 30, at the age of 85. A Smethwick man by birth, he was apprenticed at the age of 13 to William Woolaston Blake, trading as James Watt & Company, at the Soho Foundry. Later he was successively with Edward Danks (Oldbury); Tangye's, Limited, and Galloway & Company, Manchester. Finally he practised as a consulting engineer in the Birmingham area.

Cement Costs More

The price of ordinary and rapid-hardening Portland cements on the home market went up by 4s. 6d. a ton on February 1, following consultations between Mr. David Eccles, the Minister of Works, and representatives of the cement industry, in the course of which the manufacturers pleaded rising costs of coal, power, and freight to justify an increase in prices. As a result the price in London rose to £4 19s. 9d. a ton. At the same time Ministerial supervision over the prices of these cements has been lifted for, though nominally outside the statutory control of the Ministry of Works, the cement industry has previously had to seek the Minister's approval for any change in price.

The manufacturers undertook, short of any further major increases in costs, to establish a firm price for the coming year. The price of cement was raised three times in 1951, chiefly owing to higher transport charges.

FIRST QUARTER ALLOCATIONS of steel, copper, and aluminium to United States producers of consumer goods show that manufacturers of less essential items are limited to 10 per cent. of the copper and 20 per cent. of the aluminium they used before the outbreak of the Korean war. Producers of "essential" items (including refrigerators, washing machines, and vacuum cleaners) receive up to 35 per cent. of the copper and aluminium they used in a representative three-month period before Korea. Producers of both non-essential and essential products will receive an average allocation of 50 per cent. of the steel they previously used.

Application of Dilatometric Analysis to the Problem of Enamelling Cast Iron*

By Auguste Le Thomas and Pierre Tyvaert

After outlining earlier work and ranges covered to show the practical importance of the study of the comparative dilatation of metals and vitreous enamels, the Authors report on recent consolidatory investigations. It is shown that, in borderline cases, selection of enamels with suitable expansion ranges as revealed by the tests described may make the difference between success and failure of the coating.

Introduction

The importance of enamel in the foundry industry as a protective and at the same time decorative covering, is shown as much in the diversity of its application as in the importance of the corresponding manufactures. The main sections of the industry which make use of this white or coloured vitreous coating as a finish for castings are listed as makers of domestic appliances for heating and cooking, such as pots and pans; makers of sanitary ware such as baths and lavatory basins; and manufacturers of chemical apparatus, such as are used for reactions, evaporation, and Grignard syntheses. Application of enamels in this wide field demands of them certain qualities conditioned by the practical application of the goods manufactured; because of this, the importance of certain controls, based on physical, chemical and mechanical experiments, should not be minimized. For this reason, one of the Authors[1], in response to a request made by the *Chambre syndical des fabricants d'appareils de chauffage et de cuisine*, about 20 years ago had carefully examined certain characteristics of vitreous enamels when applied on cast iron.

To start with, it was then necessary to examine the efficiency of the substitution, then quite recent, of lead-free enamels for leaded enamels. Until then, the latter were used with success from the technical point of view, but were likely to cause hazards to enamel-works personnel in the form of lead poisoning. Such a comparative study to-day, in order to complete a record of purely practical facts, calls for laboratory experiments permitting more scientific results, and hence brings a more technical contribution to the explanation of some defects or imperfections of the enamel. Thus it has been decided to focus attention on experimental methods which permit enamelled castings to be qualified against their most important practical properties. This has meant mainly, with regard to heating appliances, retaining the physical qualities of the goods in the warehouse and during use.

Apart from certain attempts at chemical attack using such reagents as saline and hydrochloric-acid mists, and sulphuric- and acetic-acid gases, particular attention has been paid to cracking[2]; indeed, the significance of this characteristic depends essentially on the thermal conditions to which appliances are submitted. An arrangement has been made to compare different kinds of enamel as to heat-resisting qualities in conditions which can be fairly easily reproduced. Elsewhere, the general sensitivity to fine breaks in enamel, known as crazing, is made up to a large extent by agreement or otherwise between the coefficient of expansion of the enamel and that of the iron-base; and for this reason, the Authors have worked on these expansion analyses.

The Authors were particularly interested in the results of such experiments with regard to their practical applications and complementary studies carried out on the basis of this early work have been continued since at the *Centre Technique des Industries de la Fonderie*, with the help of Mr. Kuhn and Mr. Richard, and in this Paper the Authors recommence their observations on the application of thermal analysis to the enamelling of cast iron.

Expansion Properties of Cast Iron and Enamel

Three fundamental facts must first be set out, as they serve as the basis of the Authors' reasoning:

(1) Boro-silicate enamels, with physical properties very similar to those of glass, are characterized like the latter by a much higher sensitivity to tension than compression[3]; the size order of the theoretical minimum breaking loads should be at least as follows[4]:—

Tensile—2 to 5 kg. per sq. mm.

Compression—100 to 120 kg. per sq. mm.

(2) The cooling rates of cast iron and of enamel are not the same, even if the exterior conditions of calorific loss by radiation and convection are the same. Thus for relatively flat castings (as, for instance, those used in the manufacture of heating appliances) the enamel coating will cool in general more quickly than the cast iron, in spite of a specific heat higher than the iron; the greater thickness of the metal must be taken into account.

(3) When the enamel has solidified (its temperature being less than the softening point, which is about 400 to 500 deg. C.) it obviously is no longer able to follow the deformations of the metal in a plastic manner. Being more fragile than the cast iron, it will thus be submitted on its part to tensions of a mechanical nature, which are likely to endanger its structure.

Now these principles have been set out, the cooling speeds of the two materials and the respective

* Papèr presented to the 14th Congress of the Association Technique de Fonderie, and translated from *Fonderie*, by Jean V. Lowdon.

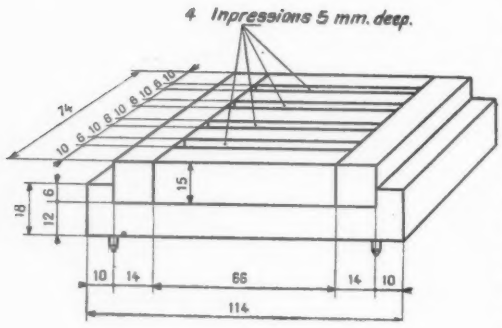


FIG. 1.—*Mould used for making Test-pieces from the Enamel Frit suitable for use in the Dilatometer.*

contractions which ensue, must be considered, allocating symbols as given in Table I.

TABLE I.—*Relative Cooling of Enamel and Iron.*

—	Temperature of the enamel.	Temperature of the cast iron.
Instant θ_1 (firm setting of the enamel)	t_1	t'_1
Instant θ_2 (during subsequent cooling)	t_2	t'_2

The cooling of the enamel is more rapid than that of the cast iron, thus:—

$$t_1 - t_2 > t'_1 - t'_2 \quad .. \quad .. \quad .. \quad .. \quad (1)$$

In the space of time between instants θ_1 and θ_2, the individual contractions of the two materials, taken separately for simplicity of working, are as follow:—

Enamel, $c = (t_1 - t_2)\alpha$

Cast iron, $c' = (t'_1 - t'_2)\alpha' \quad .. \quad .. \quad .. \quad (2)$

α and α' representing respectively the coefficients of mean linear expansion of enamel and cast iron over the temperature range between the softening point of the enamel and room temperature. For reasons previously shown, it is necessary to eliminate strains caused by the different rates of contraction of the enamel and cast iron. Therefore,

$$c < c'$$

With regard to equations (1) and (2), this implies first:

$$\alpha < \alpha'$$

but this qualitative condition is not enough. It is, in fact, necessary to satisfy the inequality,

$$(t_1 - t_2)\alpha < (t'_1 - t'_2)\alpha'$$

whence comes $\alpha < \left(\frac{t'_1 - t'_2}{t_1 - t_2}\right)\alpha'$.

To sum up, the equality of the mean linear coefficients of expansion of the two materials would only be admissible if the cooling was isothermal.

Thus, it is necessary to lessen the given inequalities of temperatures by choosing an enamel having a coefficient of mean linear expansion less than that of the cast iron, the difference being substantially greater as the variation of cooling speeds of the two materials is more marked.

Composite Coatings

In the case of a composite coating, as is used in majolica enamelling, there is evidently an intermediate layer (white enamel forming a reflector) between the metal and the transparent glaze cover; supplementary tensions can also arise at the enamel/enamel interface. It is obviously interesting that the two enamels present neighbouring coefficients of expansion, while presenting respectively against the coefficient of expansion of the metal, the condition stipulated above. For reasons which have just been examined, it would appear reasonable to believe that the coefficient of expansion of the glaze enamel can be slightly less than that of the ground-coat.

Measuring with the Dilatometer

In their experiments, the Authors used the differential dilatometer of Mr. Chevenard.[5] It is germane to recall the principle of this remarkable instrument, universally known and appreciated, the use of which has in particular allowed the study of thermal transformations of metal alloys. The sample studied is opposed to a check-sample of the same length made in Pyros (a nickel/chrome/tungsten alloy, the expansion of which is reversible and free from arrest points), serving also as pyrometer couple. The difference of expansion of the sample and the Pyros is automatically registered, either optically, photographically, or by means of a pen on a roll of paper. The Authors chose the type of apparatus with the mechanical register, because the indications are sufficiently precise for their experiment, and it is the only kind which allows the operator to follow the thermal evolution of the sample. This is an important advantage, as will be seen later.

Dilatometric Test-pieces

Cast Iron.—The standard test-piece is made up by a parallelopiped of 65 by 5 by 5 mm. or by a cylinder 65 mm. long and 5 mm. dia.

Enamel.—A special device, also invented by Mr. Chevenard, allows the dilatometric study of a substance which is difficult to machine, by using

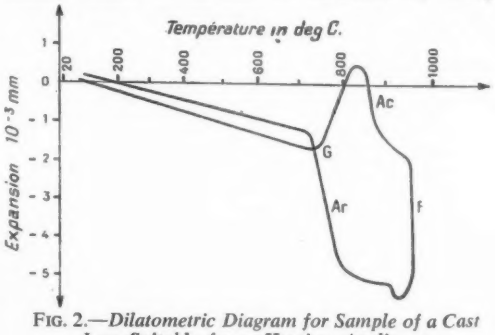


FIG. 2.—*Dilatometric Diagram for Sample of a Cast Iron Suitable for a Heating Appliance.*

fragments of it placed end-to-end after rough grinding. Nevertheless, the Authors attempted to make the enamel test-pieces to a large extent with the same geometric characteristics as the cast iron. After many attempts, paying particular attention to the constitution of the mould, satisfactory results were achieved by pouring the enamel into a collapsible ingot-mould in red copper, set horizontally. Fig. 1 shows schematically the device used, made up of four moulds of the test-piece, these being lined before pouring with a strip of red copper of about 0.05 mm. thickness to allow easy stripping. Enamel of the necessary fluidity was obtained by melting the frit in an electric furnace at a temperature of about 1,000 to 1,100 deg. C.

Pouring is done in the usual way into a cold ingot-mould, but it would perhaps be of advantage to preheat the mould in the case of enamels which are sensitive to thermal shock, or very viscous enamels, characterized by rapid setting. At the time of writing, the Authors are studying another type of mould which is refractory, and covered inside with 0.05-mm. alloy foil resistant to hot oxidation, such as Inconel. They are also trying to mould by means of cold agglomeration with powdered enamel and sodium silicate with further drying and heating. Comparison of dilatometric curves obtained from this process with the former process will show the worth of the second method.

Method and Results

In the case of the enamel test-piece, one has to control the extent of the heating and to stop in the neighbourhood of the softening point of the enamel which is relatively low (400 to 500 deg. C.) so as to avoid " buckling " of the test-piece which would dangerously affect the value of the measurement. In Figs. 2 and 3 are shown diagrams obtained respectively for a test-piece taken from a thin grey-iron casting (suitable for the manufacture of stove grates, and sanitary ware) and for a test-piece of white enamel (ground-coat) used in the " powder-

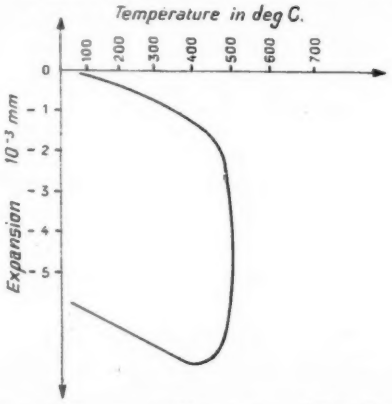


FIG. 3.—*Dilatometric Diagram for a White Enamel of the Type for Application by the Powder Process.*

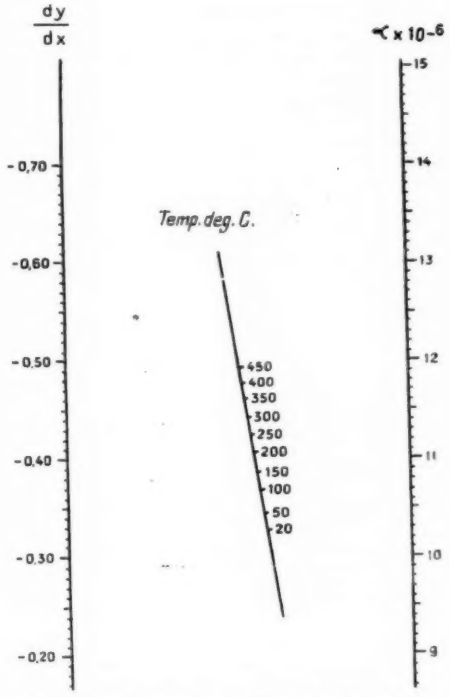


FIG. 4.—*Graph for the Determination of Coefficient of Linear Expansion using the Chevenard Dilatometer with a Mechanical Registering device* $\left(\frac{k_1}{k_2} = 0.59\right)$

enamelling " technique. The temperatures are shown on the axis of the abscissæ and the differences of expansion between the sample and the Pyros on the axis of ordinates.

In the case of the enamel—apart from the determination of the expansion itself—the softening point can be found by such a diagram, by drawing a tangent to the vertical part of the curve.

Coefficient of Linear Expansion

The determination of the coefficient of linear expansion, for each temperature taken between room temperature and the softening point of the enamel, necessitates a knowledge of the derivative at the corresponding point of the curve registered: for this purpose it is best to make use of the graphical method consisting of plotting tangents[6] and measuring *dx* and *dy* in millimetres.

Working out the correct coefficient of expansion α is effected then by application of the formula

$$\alpha = \alpha \text{ Pyros} + \frac{k_1}{k_2} \times \frac{dy}{dx} (\alpha \text{ Pyros} - \alpha \text{ silica})$$

in which $\frac{k_1}{k_2}$, the constant for the apparatus used, represents the relation of the coefficients of

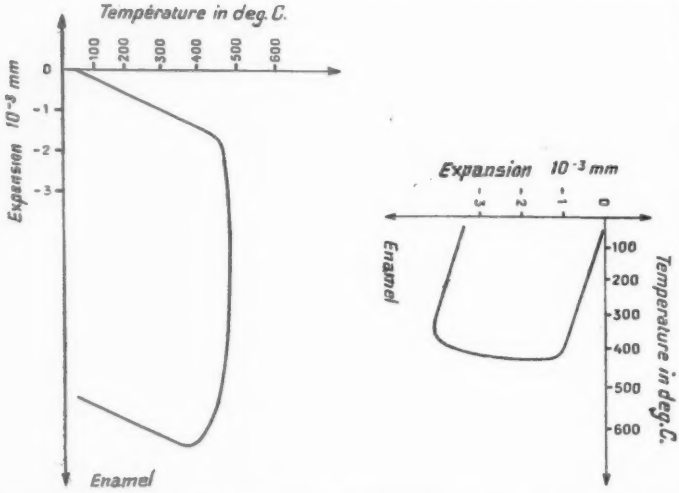


FIG. 5.—*Dilatometric Curves given by No. 1 (Good) and No. 2 (Bad) Enamels.*

amplification following the two axes of the mechanical tripod of the apparatus. In order to avoid this calculation, a diagram (Fig. 4) has recently been drawn up, the parallel lines of which correspond respectively to $\frac{dy}{dx}$ and $\alpha \times 10^{-6}$. The oblique line is graduated by temperature. Thus in practice it is possible to ascertain the true coefficient of expansion for temperatures ranging from 50 or 100 deg. C. (following the shape of the curve) in the zone where the enamel is solidified. This determination most often takes place on the part of the curve corresponding to the cooling of the material; in fact, the mechanical occurrences which can affect the enamel happen significantly after its final solidification, when the casting is withdrawn from the furnace. In this way, it is easy to deduce the value of the coefficient of mean linear expansion in the temperature-zone indicated.

(NOTE: A direct comparison is also possible, in the same appliance, of the expansion of enamels and of metals which they are to cover. Such a method, applied with the normal differential connection of the mechanical dilatometer would consist of substituting a cast-iron test-piece for the Pyros stick; but, in this case, the temperature range would not be clearly defined, and would vary from one experiment to another. Also, it would be necessary to use the triple dilatometer envisaged by Mr. Chevenard in order to definitely allow normal pyrometric registering by means of the Pyros.)

Examples

Control of the manufacture of enamels.—The physical properties of glass and co-relatively, of enamels, roughly satisfy a law of additivity, expressed by the general formula:—

$$A = p_1x_1 + p_2x_2 \ldots \ldots \ldots p_nx_n$$

in which A represents the specific value sought; $p_1, p_2 \ldots p_n$ the weights of the oxide constituents (such as SiO_2, Al_2O_3, K_2O, etc.) and $x_1, x_2 \ldots x_n$ factors corresponding respectively to the oxides. Winkelmann and Schott[6] were the first to show that the coefficient of expansion of glass could be roughly calculated on the basis of the law given above. After them, other Authors, among them Mayer and Havas[7], S. English and W. E. S. Turner[8], have applied the same principle while suggesting new systems of coefficients. Manufacturers of enamel also make use of this empirical rule when first working out their mixes.

However, although such a method, which may be used easily, often helps one to make certain corrections, and in particular to avoid a composition which is likely to have unsuitable expansion, the fact still remains that guesswork plays a large part in most cases. It is therefore particularly useful to carry out, on a type of enamel previously decided upon, verification tests on the lines of the dilatometric analysis previously described. When they had been told of this interesting possibility, many enamellers who make their enamel themselves, were eager to send samples of frit to the Authors with a view to having a satisfactory determination of the coefficient of the mean linear expansion.

Contribution to the explanation of certain enamelling faults.—During their early experiments,[2] the Authors had examined several kinds of associations of enamel coverings—glaze/enamel/white-opaque/cast-iron—which is characteristic of powdered "majolica" enamelling, and had shown differences as to their thermal make-up; in particular, the theoretical differences of temperature permissible between the casting and the ground-coat were considered, in order to prevent the latter being compressed.

Referring back to the condition of compression of the enamel expressed before:—

$$(t_1 - t_2)\ \alpha < (t'_1 - t'_2)\ \alpha'$$

one gets, calling Δt the maximum difference of temperature admissible between the enamel and the cast iron:—

$$t_1 - t_2 = t'_1 - t'_2 + \Delta t$$

which results in:—

$$\Delta t < \frac{(t'_1 - t'_2)\ (\alpha' - \alpha)}{\alpha}$$

In his documentary notes on enamelling of cast iron[9], Mr. Louis Faure had also emphasized the incidence of the thermal expansion factor on the appearance of certain defects in the enamel. Mention is made here, as an example, of the application which the Authors have been able to make of the considerations defined in the foregoing for

the study of causes of serious occurrences in manufacture encountered in a shop making enamelled sanitary ware. Some crazing (in the shape of very fine hairlines more or less localized) used to appear during cooling of the basins after enamelling in the two coats of white opaque. The technical investigation carried out on the spot, and the controls imposed at different stages in the manufacture led the quality of the enamel used to be suspected; for this reason comparative dilatometric analyses were made side by side on a frit which was known to be unsuitable, and on one giving satisfactory results. The curves in Fig. 5 corresponding respectively to the good enamel (No. 1) and the defective enamel (No. 2) have thus been obtained.

If, for example, during cooling the interval 300 to 20 deg. C. (taken in the zone where the enamel is solid) is considered, results are obtained shown in Table II for a coefficient α' of mean linear expansion of the casting equal to 12.1×10^{-6}.

TABLE II.—*Expansion Data for Good and Bad Enamels.*

Enamel.	Softening point in deg. c.	$t'_1 - t'_2$ in deg. C.	Mean α between 300 and 20 deg. C.	Δ in deg. C.
No. 1 ..	450	280	9.2×10^{-6}	88
No. 2 .	420	280	10.7×10^{-6}	36

It is thus established that, on the same metal, enamel No. 2, which caused defects in manufacture, is only suitable, bearing in mind possible temperature variations, for a relatively narrow range and is clearly inferior to enamel No. 1. It is therefore quite possible with a casting of predetermined shape and size (controlling the speed of cooling after enamelling, all else being the same) that the difference of temperature between the enamel and the cast iron should be greater, at a certain moment from between 36 and 88 deg. C. (It is clear that these values are slightly different from the true values, being shown by the average of the calculations and the hypothesis of the independence of two solids in contact.) In this case, the constraints thus imposed by the cast iron to enamel No. 2 and exceeding its capacity of mechanical resistance, could be revealed by cracks of the kind exhibited. On the other hand, and in the same operative conditions, enamel No. 1 is still under compression, thus answering the conditions set out before.

If these interesting observations, repeated, in other similar but practical cases, seem to throw some light on the subject of thermal change and how it affects the mechanical properties of enamels, nevertheless, one must remember that other factors can come into play. These will be the subject of complementary studies, amongst which must be mentioned more particularly the modulus of elasticity, specific heat, coefficient of thermal conductivity, and all these phenomena must naturally play their part in the resistance to sharp changes of temperature. As has been noticed in the case of glass, internal tensions can similarly arise in enamel coatings during production, and endanger, at the time of their liberation, the solidity and compactness of these finishes.

Conclusions

The expansion of enamels is a very important factor for their application to cast iron, and some agreement between coefficients of expansion of the enamel and the casting is indispensable. In order to investigate this characteristic, a process of separately moulding of test-pieces composed of enamel frits, permits the easy use of Chevenard's differential dilatometer. The thermal analyses thus obtainable present two applications:— (*a*) in absolute value, to the control of the manufacture of enamels, the expansion of which can only be foreseen very roughly apart from compositional formulæ. (*b*) comparatively as in relation to similar measures carried out on the cast-iron base, to predict possible defects affecting the mechanical solidity of the enamel coating.

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Steelfoundry Co-operation

Last month, nine members of the senior staff of Carntyne Steel Castings Company, Limited, Renfrew, visited the steel foundry of Catton & Company, Limited, Leeds. The party, made up of personnel including the foundry manager, fettling-shop, moulding-shop, core-shop and maintenance superintendents, spent a full day in the foundry in the company of their opposite numbers on the staff of Catton's. All information regarding the progress made in knock-off heads, core-blowing, mechanization and the method of allocating man/hours to each specific foundry operation was made readily available.

It is felt that during the visit foundations were laid for closer understanding in the future, and it is hoped that personal friendships among steelfounders will be made stronger by the interchange of such visits. It is the policy of Catton & Company, Limited, to welcome exchanges of views with members of the steelfounding industry, and this policy has been pursued for the past few years.

Lead Costs Less, Magnesium More

The Ministry of Materials has announced that from last Friday the price of imported good soft pig lead is reduced by £5 to £170 a ton, delivered consumers' works. The Ministry of Supply will make a separate announcement about the controlled price of scrap.

The Ministry of Materials has also announced that with effect from last Friday the price of virgin magnesium in ingot form is raised from 2s. 4½d. per lb. to 2s. 10½d. per lb., delivered consumers' works. The increase, the Ministry stated, was necessary because of the higher cost of imported supplies and of delivery charges.

British Blast Furnaces in the December Quarter, 1951

These tables are published through the courtesy of the British Iron and Steel Federation.

Derbyshire, Leicestershire, Notts, Northants, and Essex.

Name of firm.	In blast at end of the fourth quarter, 1951.					Weekly average in blast.	Total existing at end of quarter.
	Hematite.	Basic.	Foundry and forge.	Ferro-alloys.	Total.		
Clay Cross	—	—	1	—	1	1	2
Ford Motor	—	—	1	—	1	1	1
Holwell Iron	—	1	2	—	3	3	4
Kettering Iron & Coal	—	—	1	—	1	1	2
New Cransley Iron & Steel	—	—	1	—	1	1	2
Renishaw Iron	—	—	2	—	2	2	2
Sheepbridge	—	—	1	—	1	1	1
Stanton Ironworks: Stanton-by-Dale	—	—	5	—	5	5	5
Staveley Iron & Chemical	—	—	4	—	4	3.4	4
Stewarts and Lloyds: Corby	—	4	—	—	4	4	4
Wellingboro' Iron	—	2	—	—	2	2	3
TOTAL	—	7	18	—	25	24.4	30

Lancashire (excl. N.-W. Coast), Denbighshire, Flintshire, and Cheshire.

Brymbo Steel	—	1	—	—	1	1	1
Darwen & Mostyn	—	—	—	1	1	1	1
Lancashire Steel Corp'n	—	2	—	—	2	2	4
TOTAL	—	3	—	1	4	4	6

North-West Coast.

Barrow Ironworks	2	—	—	—	2	2	2
Charcoal Iron	—	—	1	—	1	1	1
Millom & Askam	2	—	—	—	2	2	3
United Steel: Workington	2	—	—	1	3	3	3
TOTAL	6	—	1	1	8	8	9

Lincolnshire.

Appleby-Frodingham	—	8	—	—	8	7.8	8
Lysaght, J.: Scunthorpe	—	4	—	—	4	3.9	5
Thomas, R., & Baldwins: Redbourn	—	2	—	—	2	2	2
TOTAL	—	14	—	—	14	13.7	15

North-East Coast.

Cargo Fleet Iron	—	2	—	—	2	2	2
Consett Iron	1	1	—	—	2	2	2
Dorman, Long: Acklam	—	3	—	—	3	3	4
Redcar	—	2	—	—	2	2	2
Cleveland	—	2	—	—	2	2	4
Bessemer	—	3	—	—	3	2.9	3
South Bank	—	2	—	2	4	4	3
Gjers, Mills & Co.	2	—	—	—	2	2	5
Pease & Partners	2	1	—	—	3	3.1	3
Skinningrove Iron	—	2	—	—	2	2	2
South Durham Steel & Iron	—	2	—	—	2	2	2
TOTAL	5	17	—	2	24	24	32

Scotland.

Bairds & Scottish Steel: Gartsherrie	1	1	1	—	3	3	5
Carron	—	—	1	—	1	1	4
Colvilles	—	3	—	—	3	3	3
Dixon's	—	—	2	—	2	2	6
TOTAL	1	4	4	—	9	9	18

South Wales and Monmouthshire.

Briton Ferry Works	—	1	—	—	1	1	1
Guest Keen Baldwins: Cardiff	1	2	—	—	3	3	4
Thomas, R., & Baldwins: Ebbw Vale	—	2	—	—	2	2	3
Steel Company of Wales: Margam	—	2	—	—	2	1.7	2
TOTAL	1	7	—	—	8	7.7	10

Scottish Council Needs Funds

The valuable services which the Scottish Council (Development and Industry) provides for industry north of the border are being threatened because of lack of funds. The council, which relies on voluntary contributions for its maintenance, incurred a deficit of about £8,000 last year. An appeal for funds has been circulated to local authorities, industry, trade associations, co-operative societies and other corporate bodies, trade unions and councils, and individuals. The appeal was launched by Lord Bilsland, chairman of the Council. The Scottish Council had created an effective machinery over a large part of the world, he said, particularly in Canada and the United States, to provide market research, contacts, and expert advice calculated to effect an expansion of Scottish export trade. At home it had been vigilant in ensuring that Scotland got her share of Government contracts.

Plans for the exploitation of Scotland's untapped natural resources were being examined, and under the auspices of the Council, North American companies had been attracted to manufacture in Scotland, a development that had served to increase exports, decrease dollar imports, and create employment and new types of industrial activity.

A CARGO of about 9,000 tons of Liberian iron ore arrived at Tyne Dock at the end of last month for delivery to the Consett Iron Company, Limited—the first consignment of this high-grade ore, which contains about 68 per cent. iron, to come to the United Kingdom. However, it will be followed by many more shipments and will prove of considerable help to the iron and steel industry at this time of inadequate raw material supplies.

Crompton Parkinson Director

Appointed an executive director of Crompton Parkinson, Limited, in 1946, MR. JOHN VIVIAN DANIEL became assistant managing director (works) in December, 1949, a capacity in which he assisted the joint managing directors of the company on works matters. Mr. Daniel has now been elected to the board of the Company, the appointment dating from January 25.

Well known in electrical-engineering circles, having been associated with Crompton Parkinson since 1927, Mr. Daniel has served as plant sales manager at Nottingham and Manchester, as general sales manager of the plant division, and as assistant general manager of the British Electric Transformer Company, Limited. In 1948 he was appointed deputy works director for the company's Southern Works. He recently returned from a visit to Australia and New Zealand on behalf of the Company.

British Blast Furnaces in the December Quarter, 1951—*continued*

Staffordshire, Shropshire, Worcestershire, and Warwickshire.

Name of firm.	In blast at end of the fourth quarter, 1951.					Weekly average in blast.	Total existing at end of quarter.
	Hematite.	Basic.	Foundry and forge.	Ferro-alloys.	Total.		
Goldendale Iron	—	—	1	—	1	1	2
Lilleshall	—	—	1	—	1	1	2
Round Oak Steel Works	—	—	1	—	1	1	2
Shelton Iron, Steel & Coal	—	2	—	—	2	2.8	3
Stewarts and Lloyds: Bilston	—	3	—	—	3	2.7	3
TOTAL	—	5	3	—	8	8.5	12
Sheffield.							
Park Gate Iron & Steel	—	2	—	—	2	2	2
GRAND TOTAL	13	59	26	4	102	101.3	134

Weekly Average Number of Furnaces in Blast during December Quarter, 1951, and Previous Four Quarters

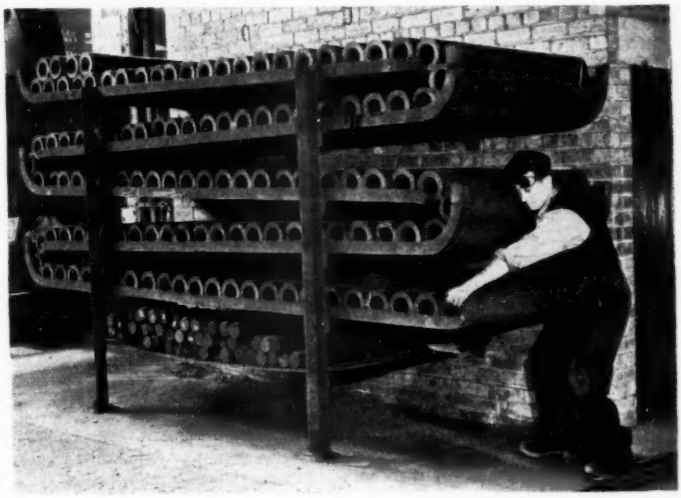
District.	1950.	1951.			
	Dec.	March.	June.	Sept.	Dec.
Derby, Leics., Notts., Northants, and Essex	25	24.8	23.9	24.2	24.4
Lancs. (excl. N.-W. Coast), Denbigh, Flint, and Ches.	4.6	4.4	3.9	4	4
Lincolnshire	14	13.3	13.5	13.7	13.7
North-East Coast	23	23	23	23	24
Scotland	9	9	9	9	9
Staffs, Shrops., Worcs., and Warwicks	9	9	9	8.9	8.5
S. Wales and Monmouth	8	7.2	7	7.5	7.7
Sheffield	2	2	2	2	2
North-West Coast	7	7.5	7.5	7	8
TOTAL	101.6	100.2	98.8	99.3	101.3

The following companies have furnaces in course of construction or rebuilding:—Barrow Ironworks (2); Cargo Fleet Iron; Consett Iron; Darwen & Mostyn Iron; Lancashire Steel Corporation; R. Thomas & Baldwins (Redbourn); Sheepbridge; Skinningrove Iron; Steel Co. of Wales; South Durham Steel & Iron.

Electrode Storage Rack

The illustration, reproduced from *Target*, shows a furnace-electrode storage rack at the foundry of Newton, Chambers & Company, Limited, Sheffield. It is so fashioned that, as one electrode is taken from the bottom, the others roll by gravity towards the discharge point. The tiers are constructed of shaped angle-iron. Not only does the system ensure the use of the oldest stock first, but stock can be estimated at a glance. Screwed nipples and short pieces of electrodes are accommodated below.

The system obviously has other applications for the handling and storage of cylindrical goods, such as pipes, tubes, rods and bars. Spherical components could be, by adaption, similarly dealt with. As a space- and labour-saving device, it is certainly noteworthy.



News in Brief

IT IS ANNOUNCED that about 200 members of Derby Railway Engineering Club may visit the French National Railways carriage and wagon workshops at Rouen, this summer.

MEMBERS of the Metallurgical Society, University of Birmingham, visited the works of the Birmingham Aluminium Casting (1903) Company, Limited, Smethwick, on January 30, and after a tour of the factory, were entertained to tea.

J. COLLIS & SONS, LIMITED, Regent Square, Gray's Inn Road, London, W.C.1, have designed and placed on the market the "Collis Stacker Manual/Electric," truck. This is a completely new design embodying a number of unique features.

THE IRON SUSPENSION BRIDGE at Milford which is to be demolished was probably made in Strutts Foundry, Belper. It is considered to be one of the earliest constructed in this country, and was built in 1826. Strutt's Foundry is now known as the Glow-Worm Boilers Limited.

ON HIS RECENT VISIT to Derby the Earl of Verulam, president of the Institute of Industrial Administration, made a tour of Aiton and Company, Limited, Stores Road, Derby; he spent some time in the foundry watching the moulders at work. He also visited the works of Rolls-Royce Limited, Derby.

THE NATIONAL RESEARCH CORPORATION is now completing the construction of a new plant in Newton, Massachusetts, to which its equipment division will be transferred in the near future. Its present headquarters on Memorial Drive in Cambridge will be used to meet its present heavy load of research and pilot-plant work.

NORTON GRINDING WHEEL COMPANY, LIMITED, of Welwyn Garden City, announce that their Birmingham office, formerly at Adderley Park, is now situated on larger premises at 99, Beaumont Road, Bourneville, where large stocks of grinding wheels and other abrasive products are available. The telephone number is: Kings Norton 3509.

DETAILS of the five registrations this year for National Service are as follow:—Men born between (all dates inclusive) January 1 and March 31, 1934, registration day was—February 2; April 1 and June 30, 1934—April 5; July 1 and September 30, 1934—June 7; October 1 and December 31, 1934—September 6; January 1 and March 31, 1935—December 6.

THE FIRST Sir Alfred Herbert paper will be presented to the Institution of Production Engineers, on March 19, when Mr. F. H. Rolt, O.B.E., superintendent of the Metrology Division, National Physical Laboratory, will speak on "The Development of Engineering Metrology" at the Royal Empire Society, London, commencing at 7 p.m. Admission will be by ticket only.

WAITING in the works of David Brown and Sons (Huddersfield), Limited, is a complicated piece of machinery known as a 36-in. spiral bevel gear unit. Its destination is the distant "Forbidden City" of Lhasa, in Tibet, and it is the last of three units ordered from the firm to form part of a water turbine generating set to provide electric power for the first time in the Tibetian capital.

THE DEPARTMENT OF APPLIED CHEMISTRY of the Northampton Polytechnic, St. John Street, London, E.C.1, announce a course of evening lectures on liquid fuels, their properties and utilization, by G. F. J. Murray, on Tuesday evenings, at 7 p.m., commencing February 26. The fee for the course is £1 and enrolment is effected either in person or by post at the Department of Applied Chemistry of the Polytechnic.

THE BRITISH OXYGEN COMPANY, LIMITED, announce that they are producing an improved version of their well-known 36-in. "Universal" Cutting Machine. Although the major structural arrangement remains unchanged, many modifications, all of which should meet with the approval of operators, have been incorporated covering the cutter and its controls, the oxygen-control panel, speed-control for the template follower, and a new drive to the latter.

MR. J. E. SITCH, manager of the Ministry of Labour and National Service, Smethwick, told the Smethwick Employment Council on January 31, that a large local foundry has plant standing idle and cannot use increased productive capacity because of a shortage of moulders. Mr. Sitch, who is secretary to the Council, stated in his report that the uncertainty of metal supplies was reflected in the number of vacancies at the many large firms in the area.

THE CAPITALIZATION of £1,194,223 by way of an issue of ordinary shares of 5s. to holders of preference and ordinary shares is announced by Sheepbridge Engineering, Limited. It is proposed to sub-divide each of the existing 10s. preference and ordinary shares into 5s. shares, to increase the authorized capital to £2 000,000 by the creation of 4,000,000 new ordinary shares of 5s., and to issue ordinary shares to both preference and ordinary holders in the proportion of three for two.

WOLVERHAMPTON CIVIC PLATE has received an historic and handsome addition in the gift from Mr. John E. Wheen of a silver soup-tureen, which originally belonged to Mr. George Benjamin Thorneycroft, the famous Midland ironmaster who, in 1848, became the first Mayor of Wolverhampton. Mr. Wheen, who is the great-grandson of George Thorneycroft, discovered the tureen in an antique dealer's shop and bought it in 1943. It had been part of Mr. Thorneycroft's personal dinner service and bears his crest and monogram.

IT IS GRATIFYING TO LEARN from the Scottish Board for Industry that provision of electric power has improved so much that staggered hours of working cease as from February 4, and that the 20 per cent. load-spreading of electricity is being cut to 10 per cent. These decisions do not indicate that the supply of power is now adequate for all purposes, but it is notable that complete cuts have not been necessary this winter. Savings of roughly 20 per cent. were effected by the staggered hours and other industrial devices, and by voluntary reductions by commercial users, whose co-operation is acknowledged by Mr. Charles Murdoch, chairman of the Board.

ADMISSION CHARGES to the British Industries Fair have been increased. The price of season tickets admitting home buyers to all three sections of the 1952 B.I.F., which will be held simultaneously in London and Birmingham from May 5 to 16, has been raised from 2s. 6d. to 5s. and admission for the public to Earls Court and Olympia in London has been increased from 1s. 6d. to 2s. 6d. Catalogues for home buyers and the public will cost 3s. instead of 2s. 6d. While these prices will obtain at all three sections, home buyers visiting the heavier engineering centre at Castle Bromwich, Birmingham, for one day only will be admitted at the existing price of 2s. 6d. The charge to the public at Castle Bromwich remains unchanged at 2s. 6d. No change has been made to the existing arrangements for overseas buyers. They will be admitted free on production of their official invitations or trade cards, and presented with free catalogues.

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The Steel Company of Wales Ltd. Over 1,000 specially designed Mazda Blended Light Fittings each using one 1,000W. tungsten and two 400W. mercury vapour lamps were supplied for the lighting of the new Rolling Mills.

Messrs. Glenfield & Kennedy Ltd. In all, more than 1,000 Mazda Fluorescent Twin Lamp Reflectors light 130,000 square feet of the Kilmarnock Works of this famous Hydraulic Engineering Company.

Messrs. J. Marlow & Sons Ltd. At this Northampton factory where the famous 'Waukeezi' shoes are made, the lighting system has recently been renewed and Mazda Fluorescent Reflectors have been installed.

The Northern Aluminium Co. Ltd. This important new Rogerstone (Mon.) factory has been lighted with over 800 Mazda Tungsten Lamp Low Temperature Overlamp Reflectors.

Pig-iron and Steel Production

Statistical Summary of November Returns

The following particulars of pig-iron and steel produced in Great Britain have been extracted from the Statistical Bulletin for December, issued by the British Iron and Steel Federation. Table I summarizes activities during the previous six months; Table II gives the production of steel ingots and castings in November, Table III gives deliveries of finished steel, and Table IV the production of pig-iron and ferro-alloys in November. (References applicable are given at the foot of column 2.)

TABLE I.—*General Summary of Pig-iron and Steel Production.* (*Weekly Average in Thousands of Tons.*)

Period.	Iron-ore output.	Imported ore consumed.	Coke receipts by blast-furnace owners.	Output of pig-iron and ferro-alloys.	Scrap used in steel-making.	Steel (incl. alloy).			
						Imports.[2]	Output of ingots and castings.	Deliveries of finished steel.	Stocks.[3]
1949	258	169	199	183	188	17	299	233	1,071
1950	249	174	197	185	197	9	313	239	997
1951—June	315	159	204	183	182	7	308	262	737
July	299	162	202	182	153	9	256	226	706
August[1]	280	176	203	181	147	8	266	190	713
September	303	184	207	190	175	10	303	253	659
October[1]	278	180	210	190	174	11	301	243	595
November	280	192	215	196	182	13	316	250	568

TABLE II.—*Weekly Average Production of Steel Ingots and Castings in November*, 1951. (*Thousands of Tons.*)

District.	Open-hearth.		Bessemer.	Electric.	All other.	Total.		Total ingots and castings.
	Acid.	Basic.				Ingots.	Castings.	
Derby, Leics., Notts., Northants and Essex ..	—	3.2	10.4 (basic)	1.6	0.2	14.7	0.7	15.4
Lancs. (excl. N.W. Coast), Denbigh, Flints., and Cheshire	1.7	21.0	—	1.8	0.6	23.9	1.2	25.1
Yorkshire (excl. N.E. Coast and Sheffield) ..								
Lincolnshire	—	28.4	—	—	0.2	28.4	0.2	28.6
North-East Coast	1.7	59.6	—	1.2	0.5	61.1	1.9	63.0
Scotland	4.4	35.7	—	1.5	0.8	40.3	2.1	42.4
Staffs., Shrops., Worcs. and Warwick	—	15.7	—	0.8	0.8	15.7	1.6	17.3
South Wales and Monmouthshire	8.2	57.2	5.8 (basic)	1.0	0.1	71.7	0.6	72.3
Sheffield (incl. small quantity in Manchester) ..	9.1	25.6	—	8.9	0.6	42.1	2.1	44.2
North-West Coast	0.6	1.6	5.2 (acid)	0.3	0.1	7.7	0.1	7.8
Total	25.7	248.0	21.4	17.1	3.9	305.6	10.5	316.1
ctober, 1951[1]	24.9	232.8	22.2	17.0	3.7	290.3	10.3	300.6
ovember, 1950[1]	27.3	268.0	21.6	15.7	3.4	326.8	9.2	336.0

TABLE III.—*Weekly Average Deliveries of Non-alloy and Alloy Finished Steel.* (*Thousands of Tons.*)

Product.	1949.	1950.	1950.	1951.	
			Nov.[1]	Oct.[1]	Nov.
Non-alloy steel:					
Ingots, blooms, billets and slabs[4]	4.5	3.6	4.3	3.9	4.2
Heavy rails, sleepers, etc.	9.8	11.3	12.3	9.6	10.3
Plates ¼ in. thick and over ..	39.2	40.0	43.1	43.5	42.8
Other heavy prod.	37.5	40.2	44.9	38.4	39.4
Light rolled prod.	46.4	47.6	53.8	47.3	46.1
Hot-rolled strip ..	17.1	19.4	21.2	19.4	19.7
Wire rods	15.4	16.3	18.5	16.2	16.4
Cold-rolled strip ..	4.9	5.5	6.4	6.5	7.2
Bright steel bars ..	5.6	6.2	7.3	6.2	6.3
Sheets, coated and uncoated ..	27.6	30.5	32.2	36.3	36.5
Tin, terne and blackplate ..	13.7	14.3	14.5	13.2	15.5
Tubes, pipes and fittings	18.5	20.0	21.9	22.4	22.7
Mild wire	12.0	12.6	13.5	12.3	12.6
Hard wire	3.2	3.5	3.8	3.7	3.9
Tyres, wheels and axles	4.1	3.5	4.0	4.3	4.2
Steel forgings (excl. drop forgings) ..	2.4	2.2	2.4	2.5	2.6
Steel castings ..	3.6	3.5	3.8	3.5	3.5
Total	265.5	280.2	307.9	289.2	293.9
Alloy steel	10.4	10.6	11.7	13.0	13.8
Total deliveries from U.K. prod.[5] ..	275.9	290.8	319.6	302.2	307.7
Add: imported finished steel ..	9.5	3.8	3.5	5.6	9.6
	285.4	294.6	323.1	307.8	317.3
Deduct intra-industry conversion[6] ..	52.8	55.6	62.2	64.7	67.7
Total net deliveries	232.6	239.0	260.9	243.1	249.6

TABLE IV.—*Weekly Average Production of Pig-iron and Ferro-alloys during November*, 1951. (*Thousands of Tons.*)

District.	Furnaces in blast.	Hematite.	Basic.	Foundry.	Forge.	Ferro-alloys.	Total.
Derby, Leics., Notts., Northants and Essex	25	—	17.8	22.4	1.5	—	41.7
Lancs. (excl. N.W. Coast), Denbigh, Flints. and Cheshire ..	6	—	7.6	—	—	1.0	8.6
Yorkshire (incl. Sheffield, excl. N.E. Coast) ..							
Lincolnshire ..	14	—	26.0	—	—	—	26.0
North-East Coast	24	7.5	38.2	0.1	—	1.4	47.2
Scotland	9	0.8	12.8	2.9	—	—	16.5
Staffs., Shrops., Worcs., and Warwick ..	9	—	8.7	1.5	—	—	10.2
S. Wales and Monmouthshire	8	3.1	25.4	—	—	—	28.5
North-West Coast	8	15.6	—	0.2	—	1.5	17.3
Total ..	103	27.0	136.5	27.1	1.5	3.9	196.0
October, 1951[1] ..	100	26.0	131.3	28.2	1.1	3.1	189.7
November, 1950[1]	102	30.2	129.9	29.1	1.1	2.7	193.1[7]

[1] Five weeks, all tables.

[2] Weekly average of calendar month.

[3] Stocks at the end of the years and months shown.

[4] Other than for conversion into any form of finished steel listed above.

[5] Includes finished steel produced in the U.K. from imported ingots and semi-finished steel.

[6] Material for further conversion into other products also listed.

[7] Includes 100 tons of direct castings.

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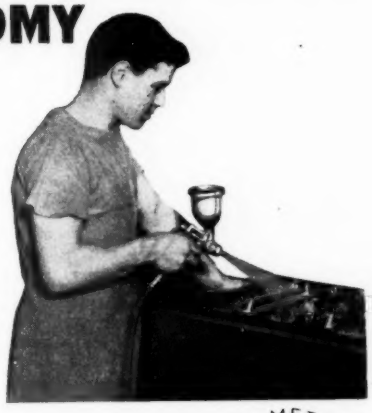

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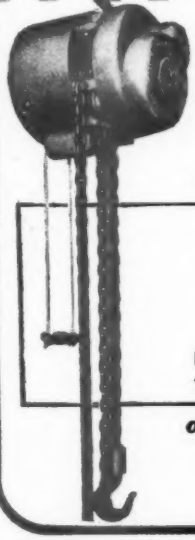

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Raw Material Markets

Iron and Steel

Stocks of pig-iron and hematite at foundries have long since been used up, and current deliveries are insufficient to cover day-to-day requirements. Many foundries are on short time, which is particularly unfortunate at a time when so much business is offering.

The engineering, speciality, and textile foundries, in particular, have for many months been short of the pig-iron chiefly used by them, including low- and medium-phosphorus, hematite, and refined iron. The supply of pig-iron to them is so short of requirements that some users would take up imported iron if this could be obtained to the desired analysis. The light and jobbing foundries are also finding it difficult to operate on the meagre tonnages of high-phosphorus iron which are available, and some of them are paying high prices for Continental pig-iron. The light foundries must inevitably play a leading role in the building programme, and some housing schemes are already being delayed by shortage of castings, particularly cast-iron pipes.

In addition to heavy commitments on home account, the foundry trade is well supplied with orders from oversea. Foundries associated with the motor and tractor industry have particularly large orders from abroad, while many of the light foundries urgently need more iron if they are to cope with both home and oversea business.

All foundries continue to be incommoded by shortages of scrap, while foundry coke deliveries, though they are just about sufficient for current consumption, do not permit of the building up of stocks. Ganister, limestone, and firebricks are received to requirements.

Home steelworks are sending as large a tonnage as possible of steel semis to the re-rolling mills, but deliveries are totally inadequate. There appears to be no immediate prospect of any improvement in the re-rollers' position. Tonnages of steel semis coming forward from the Continent are still small, efforts to obtain increased supplies meeting with little success. Most mills are on short time. There is a heavy demand for their products and orders on hand are badly in arrears. The sheet re-rollers are also in need of larger quantities of sheet bars to enable them to fulfil their extensive commitments. Arisings of defectives and crops are small and do little to relieve the shortage of prime materials.

Non-ferrous Metals

The trend of non-ferrous metal prices outside the United States continues in a downward direction, although the fall is not serious. On the Continent values are distinctly easier and buyers are showing some reluctance to purchase except for fairly near dates. Both copper and zinc command prices which are well above the controlled quotations ruling here, but that is not the case with lead, which is not easy to sell even at £160.

The reduction of £5 in the U.K. figure, bringing the Ministry of Materials' selling limit down to £170, leaves the British consumer in the position of paying some £10 more than his competitor on the Continent, while lead consumers in the United States obtain their metal at nearly £20 below the U.K. price. For this unfortunate state of affairs we have to thank bulk purchasing and price control. The Ministry's price of £170 is, of course, undersold by makers in this country of secondary refined lead, and scrap is reported to be on offer below the permitted maximum. Given a free market and the re-establishment of facilities for hedging in London, it can well be imagined that the current price level would be considerably below £170.

In the States the supply position is tight and the flow of foreign lead into the country is restricted by an import duty, still in being in spite of efforts to have it suspended. The inevitable result of the duty being, of course, that foreign lead is diverted elsewhere.

Although the tin market looked a little firmer at the end of last week, both positions lost ground on balance, the fall amounting to fully £12 per ton from Friday to Friday. Buying is on a moderate scale, but since nobody expects much setback in the market, in view of the British Government's need to find 20,000 tons of tin for the United States during the course of the present year, it is probable that buyers will show interest on every setback of any magnitude.

Supplies in the States are reported to be very tight and there has been talk of withdrawals from the stockpile in order to help the situation. Undoubtedly consumers are not getting anything like as much tin as they would like and there has been a good deal of agitation for the re-establishment of a free market in New York.

London Metal Exchange official tin quotations were as follow:—

Cash—Thursday, £987 10s. to £990; Friday, £992 10s. to £995; Monday, £997 10s. to £1,000; Tuesday, £1,002 10s. to £1,004.

Three Months—Thursday, £986 to £987 10s.; Friday, £990 to £991; Monday, £997 10s. to £1,000, Tuesday, £1,002 10s. to £1,004.

The tin market was closed yesterday (Wednesday) because of the death of the King.

Amendments to Steel Distribution Scheme

An Order authorizing a number of adjustments in the iron and steel distribution scheme which came into operation on Monday has been made by the Minister of Supply, Mr. Duncan Sandys. Consumers may use the stock held at the close of February 3, 1952, for a purpose for which they hold a control authorization. The holder of a control authorization may send material out on loan to be worked up for him. This amendment is designed to cover the "free-issue contract" customary in some trades for outside processing of material.

Two new items—wire rod reinforcement fabric mesh and wire reinforcement fabric mesh—are added to the list of controlled forms of steel. The list of small quantities exemptions has been extended to permit the purchase without licence of 5 cwt. a month of these items and also one ton a month of "Large Spring."

The Order is the Iron and Steel Distribution (Amendment No. 1) Order, 1952 (S.I. 1952, No. 172), and is obtainable from the Stationery Office (price 4d). An "Amendment No. 1, February, 1952," to the "Notes for Consumers, January, 1952," is also being issued by the Stationery Office.

The Ministry of Supply has also announced that, as from April 1, 1952, the separate allocation of non-alloy steel sheet will be abandoned and that thereafter such steel sheet will, for allocation purposes, be merged in general non-alloy steel.

Consumers will be free to decide for themselves, within their total authorized tonnage, how much they wish to order in the form of non-alloy sheet steel and how much in the form of other non-alloy steel (other than tinplate, terneplate and black plate, which will remain subject to separate allocation as at present). Outstanding sheet allocations on forms M (Sheets) will still be valid with their legal requirements unchanged.

A NEW COMPANY to be incorporated in Northern Rhodesia plans to build a foundry at Ndola costing £25,000.